Heating Piping & Air Conditioning

NOV 1 0 1943

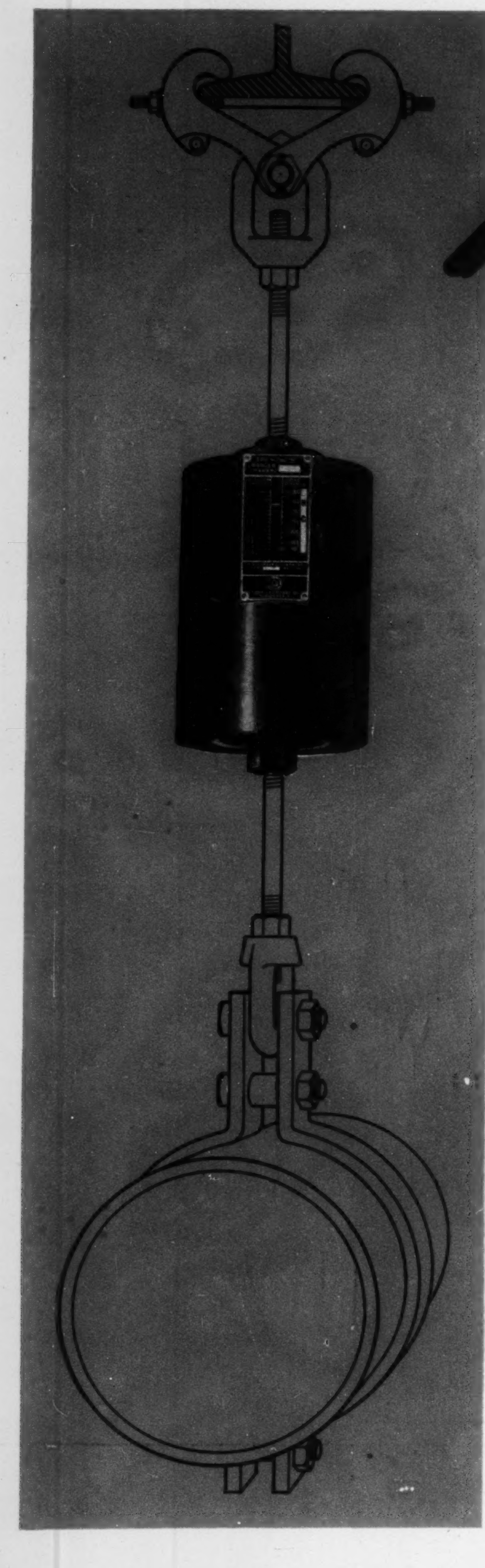
DESIGN
INSTALLATION
OPERATION
MAINTENANCE

NOVEMBER · 1943

INDUSTRIAL
COMMERCIAL
AND LARGE
BUILDINGS

599: Journal Section of the American Society of Heating and Ventilating Engineers

CONTENTS . . . PAGE 69



New!

GRINNELL
Pre-Engineered
SPRING HANGERS

14 Sizes with a Load Range from 84 lbs. to 4700 lbs.

Piping engineers who have struggled with the design of simple spring hangers to support modern flexibly supported piping systems will welcome this new Grinnell Spring Hanger. It is now possible to select a stock size of hanger from a simple table after the load has been computed.

MINIMIZES CHANGES IN PIPE SUPPORTING FORCE

ALL-STEEL WELDED CONSTRUCTION MEETS PRESSURE PIPING CODE

UNIQUE SWIVEL COUPLING PROVIDES ADJUSTMENT AND ELIMINATES TURNBUCKLE

COMPACT—REQUIRES MINIMUM HEADROOM

INSTALLATION IS SIMPLIFIED BY INTEGRAL LOAD SCALE AND TRAVEL INDICATOR

14 SIZES AVAILABLE FROM STOCK

EASY SELECTION OF PROPER SIZE FROM SIMPLE CAPACITY TABLE

You will want complete details and engineering data on this new Pre-Engineered Spring Hanger Fig. 268. Write for copies of the descriptive folder. Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch Offices in principal cities.

GRINNELL

WHENEVER *Piping* IS INVOLVED

Heating
Piping &
Air Conditioning

with which is merged the Aerologist

Design, Installation,
Operation, and Maintenance

Industrial, Commercial,
and Large Buildings

Board of Consulting & Contributing Editors

. R. Bernz, Sabin Crocker, R. C. Doremus, hilip Drinker, Walter L. Fleisher, F. E. iesecke, William Goodman, William A. anley, J. J. Harman, R. S. Hawley, E. P. eckel, R. E. Hieronymus, J. C. Hornung, ohn Howatt, Lee P. Hynes, C. W. Kimball, wight D. Kimball, A. C. Kirkwood, Charles . Leopold, Samuel R. Lewis, H. C. Murphy, lfred J. Offner, F. B. Rowley, Robert P. choenijahn, Kalman Steiner, T. S. Tenney, ush D. Touton, Eph. A. Tyler, W. H. Wilson

Editor
. M. Burnam, Jr.

Assistant Editor
Margaret Marshall

Advertising Staff

Wallace J. Osborn
New York
Telephone: Murray Hill 9-8293

James D. Thomas
Chicago
Telephone: State 6916

Robert A. Jack
Cleveland
Telephone: Yellowstone 1540

J. Howard Tinkham
Los Angeles
Telephone: Richmond 6191

Publisher
Frank P. Keeney

Manager
Chas. E. Price

blished monthly by the Keeney Publishg Co., 6 N. Michigan Ave., Chicago 2. elephone: State 6916/ Subscriptions: U. S. d possessions, Canada, Mexico, Central merica, South America, $2.00 per year; her, $4.00. Current copies, U. S. and possions, 25c each, back copies 50c each. nuary, 1943, issue, $1.00 per copy/ Memr of Audit Bureau of Circulations and e Associated Business Papers, Inc./

Copyght, 1943, by the Keeney Publishing Co.

IN THIS ISSUE

Volume 15 November 1943 Number 11

The Editor's Pages (news and comment) .... front section 65

The Drying of Foods, by W. R. Marshall, Jr. 567

Floor Heating System in Hangar Conserves Metal, by J. K. Fairbairn and John D. Dillon 573

Refrigeration Industry Has Poor Safety Record 576

Installing Big Valve in Gas Main Without Interrupting Service 578

Draining Superheated Steam Line With Thermostatic Bellows Traps (reader's question answered) 580

Sam Lewis' Page (planning now for postwar installations) 581

Coal Is Vital War Material (how to save it), by John Howatt .. 582

"Open for Discussion" (coordination of dimensions of building materials and equipment; decentralized or centralized air conditioning systems?) 585

Heating Industrial Buildings With Direct Fired Air System, by D. Henderson 587

Stainless Steel Pipe, Valves, and Fittings Resist Corrosion of Hormone Process 589

Cold Bending of Pipe for Fighting Ships, by Joe Klein 590

Welding Society Hears Reports on Piping and Tubing 591

Air Conditioning and Heating Laboratory Supplements Classroom Instruction, by J. H. Carpenter 592

Measuring the Flow of Fluids, by William Goodman 596

Equipment Developments .... back section 135

Recent Trade Literature .... back section 156

New Books & Reports .... back section 162

WPB . . . OPA . . . PAW . . . Etc. (new government orders and news releases) .... back section 171

Meetings & Conventions .... back section 176

Index to Advertisers .... back section 178

Journal Section of the American Society of Heating and Ventilating Engineers

50th Anniversary Meeting 599

Optimum Surface Distribution in Panel Heating and Cooling Systems, by B. F. Raber and F. W. Hutchinson 602

Nominees for Members of Council 615

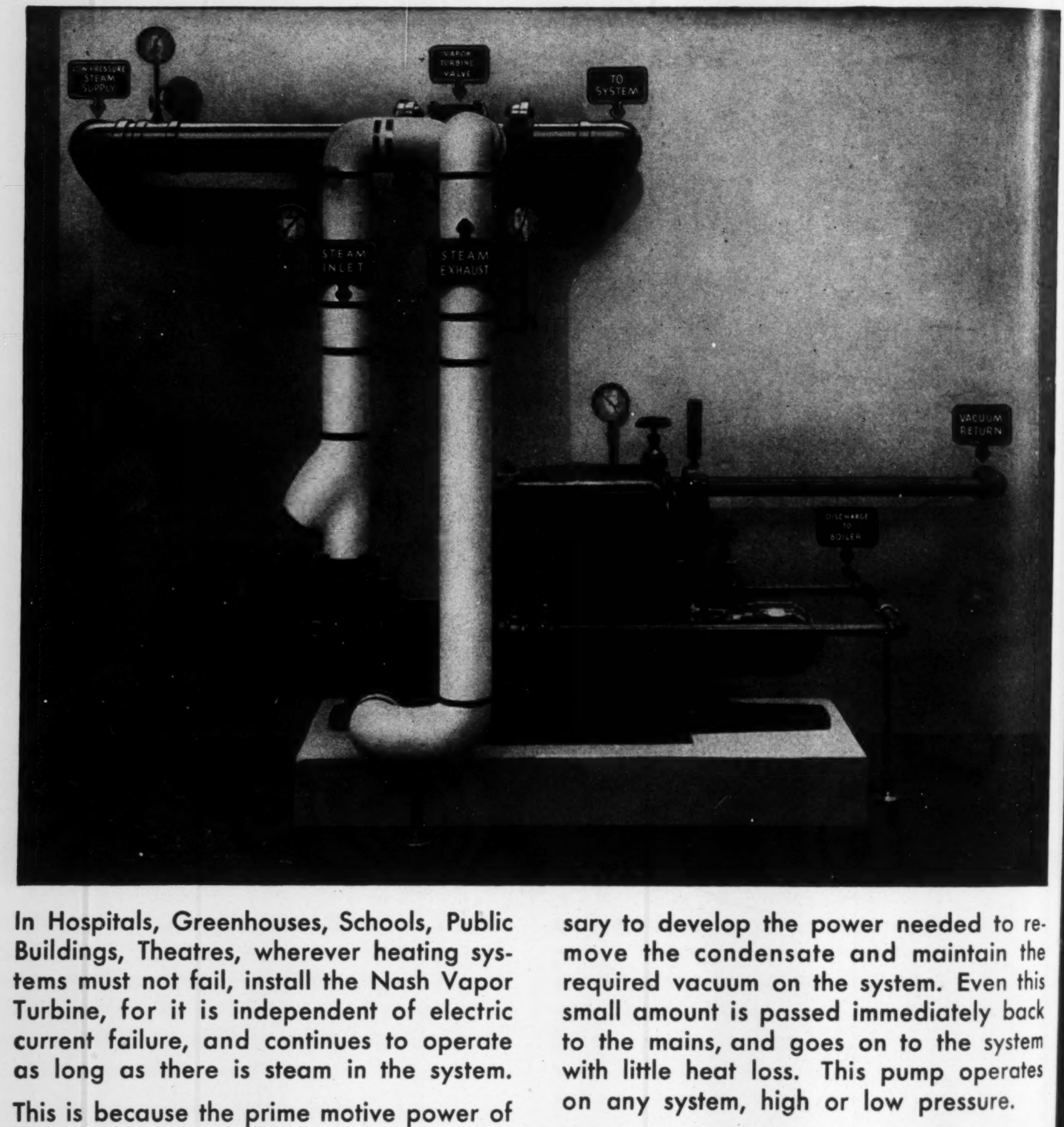
Summary of Local Chapter Meetings 617

Candidates for Membership 619

Candidates Elected 620

Officers, Council, and Committees 621

Interrupted Electric Service will not stop this NASH Heating Pump!



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is independent of electric current failure, and continues to operate as long as there is steam in the system.

This is because the prime motive power of this economical pump is a special steam turbine, controlled by a unique "Vapor Turbine Valve", which automatically bypasses from the heating main a small portion of steam, the exact amount necessary to develop the power needed to remove the condensate and maintain the required vacuum on the system. Even this small amount is passed immediately back to the mains, and goes on to the system with little heat loss. This pump operates on any system, high or low pressure.

The Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump. Bulletin on request.

THE NASH ENGINEERING COMPANY
205-A WILSON ROAD, SOUTH NORWALK, CONNECTICUT, U. S. A.

The DRYING of FOODS

W. R. Marshall, Jr., Illustrates by an Example of Dryer Design Worked Out in Detail Some of the Many Air Conditioning Problems Involved in an Important Wartime and Postwar Industrial Process

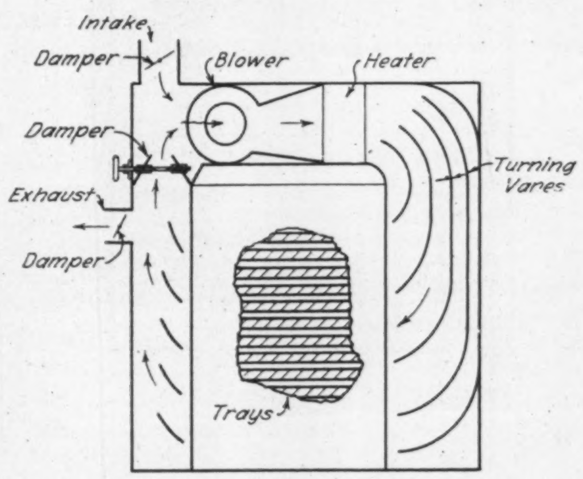


Fig. 1—Diagrammatic Sketch of Compartment Type Dryer

As the importance of food drying gains momentum with each passing month, it is a necessary consequence that more and more serious attention will be paid to actual dryer performance and operation. For this reason, it is imperative that a thorough understanding of the engineering fundamentals of drying be had by those responsible for food drying operations. It behooves the manufacturer of dried foods to be thoroughly familiar with the methods of performing the drying operation more efficiently if he has an eye on postwar production and competition. It also is equally important that sound engineering principles be understood and applied if dried foods are to be acceptable to the American public as a quality product after the war.

One method of gaining familiarity and an understanding of the engineering principles involved in a drying process is by performing an actual design of a dryer to meet a hypothetical production requirement of a given dried food. Let us consider a compartment or batch type where the food is dried in trays which remain in one position in the dryer throughout the drying cycle. Fig. 1 is a diagrammatic sketch of such a dryer.

The compartment type dryer is used for relatively low capacities, and a familiar example at the present time is the home food dryer. The compartment dryer will generally not be called on to produce over 50 lb per hr of a dried food. This is equivalent, roughly, to the processing of 200-400 lb per hr of wet food, depending upon the initial moisture content. The batch operation characteristic of the compartment dryer means that for most of the time unsteady-state conditions prevail throughout the cycle of operation; i.e., air temperature and humidity, and the food moisture content vary at any one point with time. It is well known that unsteady-state problems are not the simplest to analyze.

The Problem To Be Solved

Let it be required to design a compartment type dryer to produce 50 lb per hr of stripped potatoes with 10 per cent moisture. Experimental drying data are available, and in accordance with the development of multistage drying [see Multistage Dehydration Produces Better Food at Lower Cost, by L. V. Burton, Food Ind., 15, 51-53, May 1943], the potatoes will be dried only to 10 per cent moisture in the compartment dryer, final drying to be accomplished in a bin or compartment of large holding capacity.

The reason for this procedure is

made apparent by the drying time curve, Fig. 2, which flattens out rapidly at low moisture contents, indicating a disproportionately long time for the removal of the last percentages of moisture.

The experimental data to be used as a basis for this problem will be those for the drying of 5/32 in. potato strips reported by W. B. Van Arsdel in the ASHVE Journal Section of HPAC, 15, 157-160, March 1943. The drying time curve is shown in Fig. 2.

Although it has been claimed [see Van Arsdel's paper] that the data of Fig. 2 gave no constant-rate period, for the sake of illustrating a method of design, the first stages of drying will be considered to exhibit a constant drying rate shown on the rate curve in Fig. 3a. The constant-rate period was arbitrarily selected from the nearly linear portion of the time curve in Fig. 2, while the remainder of the rate curve was obtained by graphical differentiation. It is believed that this procedure does not invalidate the method illustrated here, and it might be generally applied when the time curve has a steep, sloping portion.

If the drying rate could be expressed on an area basis, it is probable that a true constant rate would be obtained. This follows because the food is at the wet bulb temperature for a period of time, indicating surface evaporation, the necessary condition for a constant drying rate. However, the shrinkage of the food prevents accurate measurement of the surface area, and the drying rate is therefore expressed on a weight basis, i.e., lb of water evaporated per hr per lb of dry food.

Timely

The rapidly expanding demand for dried foods to meet Army, Navy, and lend-lease requirements is forcing more and more plant engineers and operators, consultants, contractors, and others to become familiar, in a relatively short time, with the field of drying and its ramifications. It was the purpose of a previous series of articles by Mr. Marshall, published in the September 1942-December 1942 issues of HPAC, to present a general picture of industrial drying practice and theory, and to show how they may be applied to food drying in order that those who are becoming acquainted with problems of drying for the first time may be able better to understand the underlying principles involved. An article in the January 1943 HPAC considered some of the problems involved in the selection, design, and operation of dryers which are adaptable to the drying of foods. This month, detailed calculations for a dryer of one type are given, the calculations illustrating the air conditioning problems involved.

The author has specialized in the subject of drying, and is connected with the technical division of the engineering department at E. I. du Pont de Nemours & Co.

The data of Fig. 2 have been adjusted to large scale drying conditions by multiplying the time scale by 1.5. This tends to compensate for the ideal conditions of uniform air flow and tray loading, generally encountered in an experimental test, as well as for the size of tray used, the effect of heat conduction through the non-drying surfaces, and the high rate caused by low experimental humidities. All these factors tend to give higher drying rates than those actually obtained in large scale dryers.

The data to be used in the calculations are:

1) Air velocity over the trays, 500 fpm.
2) Tray loading, 1.5 lb per sq ft of wet potatoes at a depth of 2 in.
3) Inlet air temperature, 150 F.
4) Initial moisture content, 4.3 lb of water per lb dry food.

Tray Size and Spacing

Although tray spacing and tray

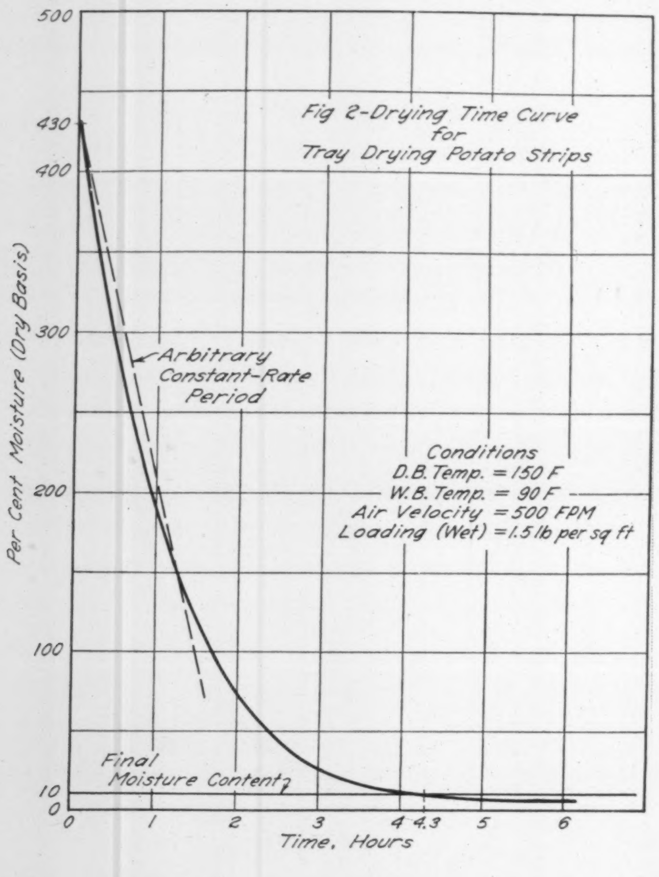


Fig 2–Drying Time Curve for Tray Drying Potato Strips

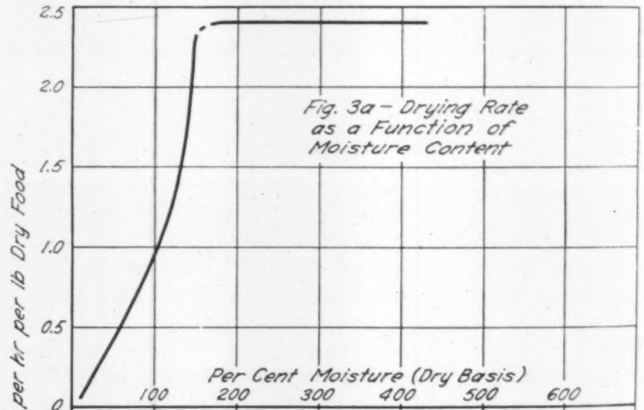


Fig. 3a – Drying Rate as a Function of Moisture Content

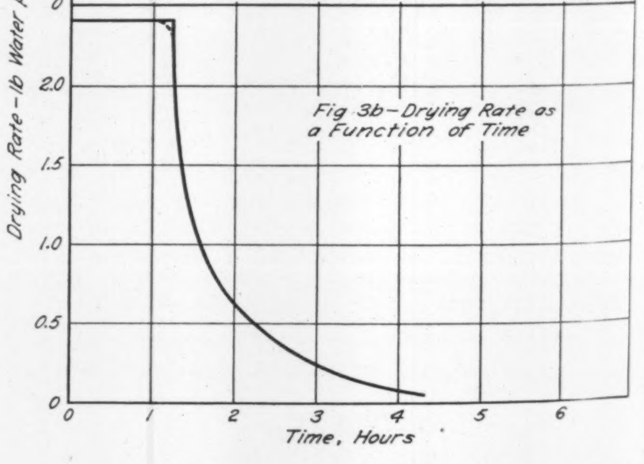


Fig 3b – Drying Rate as a Function of Time

size are generally selected arbitrarily rather than determined from calculations, nevertheless it will be of interest to indicate a method for determining the tray size from the drying data.

A heat balance over the trays at any time, assuming no heat losses, is given by

$$G' s(150 - t_2) = \lambda E \quad \ldots\ldots [1]$$

while a material balance is given by

$$G' \ (H_2 - H_1) = E \quad \ldots\ldots [2]$$

Also

$$G' = \frac{60uS}{V} = \frac{60unLD}{V} \quad \ldots . [3]$$

and

$$E = R_d W n L^2 \quad \ldots\ldots [4]$$

By substitution of [4] in [1] and [2], we obtain the following set of equations:

$$\left.\begin{array}{l} G' s(150 - t_2) = R_d \lambda W n L^2 \\ G' \ (H_2 - H_1) = R_d W n L^2 \\ G' = \dfrac{60\,unLD}{V} \end{array}\right\} \quad \ldots . [5]$$

In general, heat losses and sensible heat effects could be included in equation 1 by assuming a certain percentage, say 20 per cent, of the evaporation load as losses. Then, the losses could be accounted for by multiplying the right hand member of equation 1 by 1.2. However, we shall account for these heat effects in a subsequent calculation.

It is apparent from the rate curve that E varies with time, and hence we are faced with the problem of selecting an appropriate value of E, i.e., R_d, for our calculations. In turn, the selection of E depends to a certain extent upon the temperature conditions to be maintained in the dryer. In order to observe the effect of the variables more readily, let us solve for L from the first and third equations of equations 5 and obtain

$$L = \frac{60uDs(150 - t_2)}{\lambda R_d W V} \quad \ldots\ldots [6]$$

It is apparent from this expression that the tray size will vary inversely with the drying rate, so that a conservative design would be to select a value for R_d greater than the overall average rate. The selection of this rate will also be influenced to some extent by the temperature drop which we will tolerate across the tray. In order to maintain nearly constant drying conditions, we shall select a drop of 10 F; i.e., $(150 - t_2) = 10$.

It is evident that the compartment type dryer is not of such a design that it will automatically take account of the various periods of drying because its operation is relatively inflexible, unless automatic controls are provided to change the air and temperature conditions at certain periods in the cycle to correspond with the characteristics of the drying rate curve.

The average value of R_d to be used in our design calculations should lie somewhere between the constant rate and the overall average rate. The best method of determining this average value is on the basis of the lengths of time the constant-rate and falling-rate periods endure; i.e., a time average should be used. This may be determined most readily by first plotting the rate curve as a function of time, Fig. 3b. Then the average rate is given by the expression

$$(R_d)_{ave.} = \frac{\int_0^{\theta} \left(\frac{dw}{d\theta}\right) d\theta}{\theta} \quad \ldots\ldots [7]$$

or

$$(R_d)_{ave.} = \frac{\int_0^{\theta_c} \left(\frac{dw}{d\theta}\right)_c d\theta + \int_{\theta_c}^{\theta} \left(\frac{dw}{d\theta}\right)_f d\theta}{\theta} \quad \ldots . [8]$$

where θ_c = the drying time to the critical moisture content = 1.25 hr for our problem. The first integral of the right hand term can be readily evaluated, $(dw/d\theta)_c = 2.4$. The second integral is determined graphically from Fig. 3b. Our value of R_d now becomes

$$(R_d)_{ave.} = \frac{2.4(1.25) + 1.5}{4.30}$$

$$= \frac{3 + 1.5}{4.3} = 1.05 \text{ lb per hr per lb}$$

Thus, $(R_d)_{ave.}$ lies between the constant rate of 2.4 and the overall average of 0.98 obtained from the ratio of total water removed to the overall drying time.

Nomenclature

A = area, sq ft;
C = capacity, lb of dry food per hr per sq ft;
d = symbol for differentiation;
D = free space between trays, ft;
E = total evaporation rate at any time, lb of water per hr;
G = mass rate of air flow, lb of dry air per hr per sq ft of cross section;
G' = air flow, weight basis, lb of dry air per hr;
H = absolute humidity, lb of water per lb of dry air;
L = length of a side of a square tray, ft;
n = number of trays per compartment;
q = rate of heat transfer, Btu per hr;
Q = volumetric rate of air flow, cfm;
R_d = drying rate, lb of water per hr per lb of dry food = $dw/d\theta$;
s = humid heat of air, Btu per lb of dry air per F;
S = free cross sectional area for air flow, sq ft;
t = air temperature, F;
u = linear air velocity, fpm;
U = overall heat transfer coefficient, Btu per hr per sq ft per F;
V = specific volume of air, cu ft per lb of dry air;
w = water content of food, lb of water per lb of dry food;
W = loading of food, lb of dry food per sq ft;
x = fraction of air recirculated.

Subscripts

a refers to atmospheric air;
1 refers to entering conditions;
2 refers to leaving conditions;
c refers to constant-rate period;
f refers to the falling-rate period.

Greek Letters

Δ = symbol for difference;
$(\Delta t)_m$ = mean temperature driving force, F;
λ = latent heat of evaporation of water, Btu per lb;
θ = drying time, hr.

Now substitute in equation 6 the following values: u = 500 fpm; s = 0.25 Btu per lb per F; $(150 - t_2)$ = 10 F; W = 1.5 x 0.19 = 0.285 (0.19 = fraction of dry food in 1 lb of wet food = $1 - [4.3/(4.3 + 1)]$); V = 16 cu ft per lb (average value); R_d = 1.05; λ = 1000 Btu per lb (average value).

We thus obtain

$$L = \frac{60 \times 500 \times 0.25 \times 10D}{1000 \times 1.05 \times 0.285 \times 16} = 15.7D$$

A value of D, based on usual practice, will be around 1.5 to 2.0 in. For this problem, let $D = (1.75/12)$ ft. Then,

$$L = \frac{15.7 \times 1.75}{12} = 2.3 \text{ ft or about 28 in.}$$

Hence, the tray size will be 28 in. x 28 in. x 2 in.

Number of Trays and Compartments Required

From Fig. 2, the drying time to 10 per cent moisture is observed to be about 4.3 hr. From this the capacity, C, is determined as follows:

$$C = \frac{W}{\theta}$$

$$= \frac{1.5 \times 0.19}{4.3} = 0.0663 \text{ lb per hr per sq ft}$$

The number of trays is determined from the total area required and the area per tray. The area of one tray is 5.44 sq ft.

The total area required is determined from the capacity requirement and the value of C. Hence,

$$A = \frac{50}{0.0663} = 754 \text{ sq ft}$$

Then the number of trays required is

$$n = \frac{754}{5.44} = 139 \text{ trays}$$

The number of compartments required will depend upon the arrangement of trays, and the number of trays per compartment. One method is to stack the trays in two tiers, and specify the height of these tiers as not to exceed 6 ft. Hence, in our problem we would have $2 + 1.75 = 3.75$ in. of total space per tray which would permit us to stack about 20 trays per tier, or 40 trays per compartment. Thus, the number of compartments with this arrangement would be $139 \div 40 = 3.5$. This is a fractional number of compartments, and rather than overdesign by using four compartments, let us stack our trays 23 to a tier or 46 to a compartment so that only three compartments will be required.

Air Requirements

The quantity of air required can be determined from equations 1 or 3. The two should agree, as follows:

By equation 1:

$$G' = \frac{1000 \times 1.05 \times 0.19 \times 1.5 \times 46 \times 5.44}{0.25 \times 10}$$
$$= 30{,}000 \text{ lb per hr}$$

By equation 3:

$$G' = \frac{60 \times 500 \times 46 \times 2.34 \times 1.75}{16 \times 12}$$
$$= 29{,}400 \text{ lb per hr}$$

Agreement is within 2 per cent which is satisfactory for our purposes.

The volume of air to be circulated at 150 F will be $Q = 30{,}000 \times 16/60 = 8000$ cfm, and thus a fan will be required to handle this volume against the frictional resistance offered by the structural features of the dryer; this would include the resistance of the heaters, abrupt changes in direction at corners or bends, and expansion and contraction losses out of and into the tiers of trays. The pressure drop to be overcome by the fan should not be greater than 1 to 1.5 in. of water for this type of dryer.

Recirculation and Exhaust

An additional important consideration of the air requirements is the amount of air to be recirculated or exhausted. The determination of this item is of course a function of the humidity conditions to be maintained in the dryer, and in addition (in the compartment type dryer) it is also a function of the drying rate. Actually, if experimental data are used for design, the humidity used in the tests should be the basis for design. However, it generally happens that the experimental humidity is too low for economical operation of a plant dryer.

In our problem, if no recirculation were used the average humidity rise would only be, from equation 2,

$$(H_2 - H_1)_{\text{ave.}} = \frac{1.05 \times 46 \times 0.285 \times 5.44}{30{,}000}$$
$$= 0.0025 \text{ lb per lb}$$

At the beginning of the cycle, when maximum evaporation occurs, our humidity change would be

$$(H_2 - H_1)_{\text{max.}} = \frac{2.4}{1.05} \times 0.0025$$
$$= 0.00571 \text{ lb per lb}$$

Because it is uneconomical to exhaust 100 per cent of the air, it behooves us to estimate the amount of air we can recirculate, and to base this estimate on our experimental tests. Since the test data were obtained at a dry bulb temperature of 150 F and a wet bulb temperature of 90 F, our wet bulb depression is 60 F. Since we have increased our experimental results by a factor of 1.5, let us select for our air conditions a wet bulb depression of 40 F. Hence, at 150 F dry bulb and 110 F wet bulb (29 per cent relative humidity), the air entering the trays will have a humidity of 0.0491 lb per lb of dry air. Thus, during the period of maximum evaporation we can calculate the recirculation conditions as follows:

Water in air leaving trays $= G' H_2$
Water in air exhausted $= (G' - x) H_2$
Water in fresh air $= (G' - x) H_a$
Water in recirculated air $= x H_2$

Then, by a water balance,

$$(G' - x) H_a + x H_2 = H_1 G'$$

and

$$x (H_2 - H_a) = G' (H_1 - H_a)$$
$$x = \frac{G' (H_1 - H_a)}{(H_2 - H_a)}$$

In our problem, select an average value of 0.01 for H_a. Then, since $(H_2 - H_1)_{\text{max.}} = 0.00571$, $H_2 = 0.00571 + 0.0491 = 0.0548$ and

$$x = 30{,}000 \frac{(0.0491 - 0.01)}{(0.0548 - 0.01)}$$
$$= 26{,}200 \text{ lb per hr}$$

or the per cent recirculated $= 26{,}200/30{,}000 = 87.2$.

For average conditions the value of x becomes

$$30{,}000 \frac{(0.0491 - 0.01)}{(0.0516 - 0.01)}$$
$$= 28{,}200 \text{ lb}$$

or 94 per cent recirculated. Since the equilibrium moisture content for blanched potatoes at 30 per cent relative humidity is about 2.5 per cent, this amount of recirculation may be maintained while reaching the final moisture content of 10 per cent. In operation, there would be no serious loss by setting the dampers for 87 per cent recirculation for the entire cycle.

In some cases, when initial evaporation rates are higher than those encountered in this problem, a larger fraction of air must be exhausted in order to keep the humidity at the desired value. When drying enters the falling-rate period, a series of different damper settings theoretically should be used to provide a gradually increasing percentage of recirculation and thus afford better steam economy. In order to calculate the recirculation for different periods in the drying cycle, recourse must be had to the rate curve. Thus, the fraction recirculated at various times during the falling-rate period is given by

$$x = 1 - \frac{E}{G' (H_2 - H_a)}$$

where $E = R_d W n L^2$, and R_d is obtained from the rate curve.

The changes in air conditions for the constant-rate period are shown on a section of the psychrometric chart, Fig. 4. The diagram is self-explanatory. Fig. 5 illustrates schematically the changes during the falling-rate period.

Heat Requirements

The method of determining the heat required and the size of heaters is indicated in the following calculations. The design will be based on the maximum evaporation load; i.e., the constant-rate period,

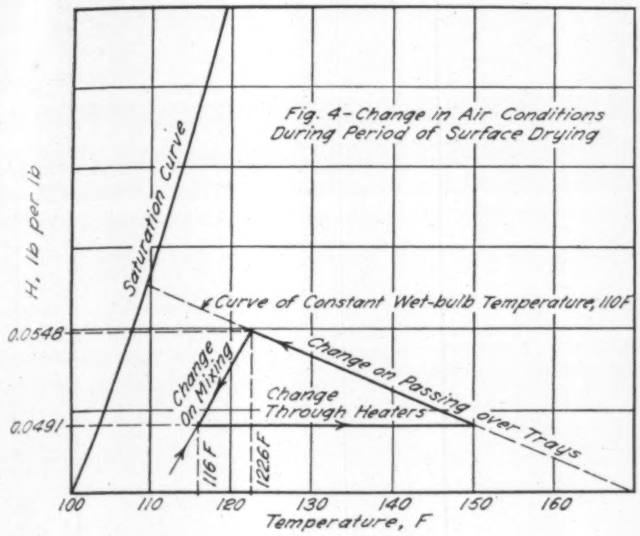


Fig. 4 - Change in Air Conditions During Period of Surface Drying

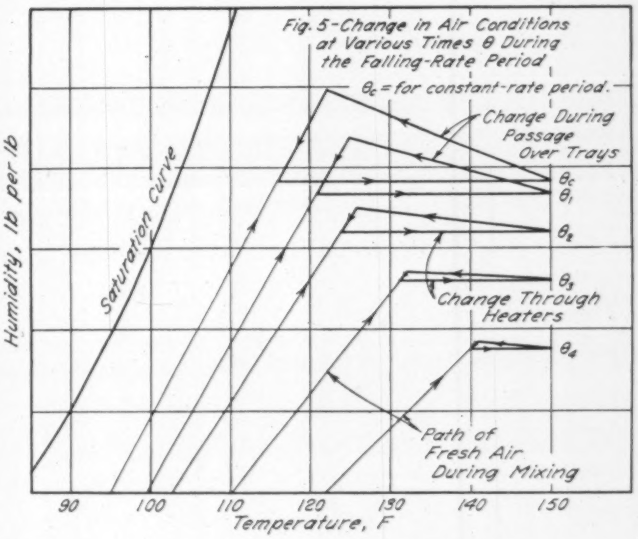


Fig. 5 - Change in Air Conditions at Various Times θ During the Falling-Rate Period

so that the heaters will be adequate to sustain the maximum demand placed on them.

The items of heat requirement comprise:

Latent heat of evaporation = $\lambda E = 1032 \times 171 = 177{,}000$ Btu per hr, where λ is taken at the wet bulb temperature of the air and E is calculated from equation 4.

Sensible heat to raise the water in the food from room temperature to the temperature of evaporation $= 171\ (110 - 70) = 6850$ Btu per hr. (It is recognized that evaporation does not take place at 110 F throughout. However, the error in overlooking this fact is partially compensated for in the value of λ.)

Superheat in water vapor $= 171 \times 0.45\ (140 - 110) = 2310$ Btu per hr, assuming an exit air temperature of 140 F. In the constant-rate period, however, the exit air temperature will be less than 140 F, so that this assumption is conservative.

The sensible heat transferred to the food itself is negligible during the constant-rate period. Hence, the heat to be furnished per hour by the air is $177{,}000 + 6850 + 2310 = 186{,}160$ Btu per hr, say 187,000.

Assume the losses are about 10 per cent of the heat transferred. Then the temperature drop of the air during the constant-rate period is

$$(150 - t_2) = \frac{187{,}000 + 18{,}700}{30{,}000 \times 0.25} = 27.4 \text{ F}$$

This temperature drop is about threefold greater than the assumed drop of 10 F used in calculating the tray area. This, of course, is due to the fact that an average drying rate somewhat lower than the maximum was used. It is important, therefore, to design the heaters to handle this drop in temperature.

The heat required to heat the fresh air from 70 to 150 F is $3800\ (150-70)\,0.25 = 76{,}000$ Btu per hr, and thus the maximum heat load corresponding to the constant rate period is $76{,}000 + 205{,}700 = 281{,}700$ Btu per hr.

It will be assumed that extended surface heaters are to be used on our dryer. The selection of a finned type heater is usually made with the aid of a manufacturer's catalog, because such heaters are generally built in standard sizes.

In our example, however, we shall simply estimate the total heating surface required, and this area may then be converted into the nearest standard size unit of any manufacturer's heaters. One method of determining the heater size is from the basic heat transfer equation

$$q = UA\ (\triangle t)_m$$

In our problem, $q = 281{,}700$ Btu per hr. We wish to solve for A. $(\triangle t)_m$ is the average temperature difference between the air stream and the heat transfer medium. If we assume that 20 psi gage steam is available, then the temperature of our heating medium is about 260 F. Our entering air temperature is calculated as follows from a heat balance for the mixing of the fresh with the recirculated air:

$$3800 \times 0.25\ (t - 70) = 26{,}200 \times 0.25\ [(150 - 27.4) - t]$$
$$t = 116 \text{ F}$$

The air temperature leaving the heaters is specified to be 150 F. The temperature difference at the entrance to the heaters is $(260 - 116) = 144$ F and leaving it is 110 F. Thus, an arithmetic average $(\triangle t)_m$ may be used, or $(\triangle t)_m = 127$ F. The value of U for extended surface heaters is a complicated function of several variables, and is generally given, for various conditions, by the manufacturer of the heating unit. For our purpose, a value of 7 for U will be selected as an average figure. For those more interested in this detail, it is suggested that reference be made to a correlation by W. H. McAdams in which the heat transfer coefficient for finned tubes has been correlated vs. a modified Reynolds' number. [See Heat Transmission, 2nd ed., 1942, p. 235, McGraw-Hill Book Co.]

The area of heat transfer is now given as

$$A = \frac{281{,}700}{7 \times 127} = 317 \text{ sq ft}$$

The maximum steam consumption to be expected will be

$$\frac{281{,}700}{941} = 300 \text{ lb per hr}$$

and the ratio of lb of steam per lb water evaporated during the constant-rate period is about 1.75 to 1, which represents reasonably efficient operation.

Some of the Mechanical Design Considerations

It is obvious that the above results represent the initial phases of the design problem, but no design can be started until these calculations have been made. The problems of mechanical design depend entirely upon the results of the estimates of air quantities, fan size, heater size, compartment size, and tray arrangement.

Other considerations might be noted with regard to the air requirements. Thus, it may be better to place the air inlet and exhaust ducts in such a position that the fan will not be required to handle both the fresh air and exhaust air at the same time. The arrangement for this procedure is shown in the sketch of the dryer, Fig. 1. An additional practical consideration would be the placing of the fan on the upstream side of the heater, thereby eliminating the flow of hot gases around the bearings, although good practice would demand that the bearings be outside the dryer to prevent oil being picked up by the air which in turn would contaminate the food.

The importance of uniform air flow over the trays and good distribution from one tray to the next should be stressed. Poor air distribution will cause many dryers to operate far below their rated capacity. Poor distribution generally results from abrupt changes in the direction of air flow without suitable baffling to aid the directional change.

An additional operating feature often used consists of periodically reversing the direction of air flow.

The problem of the operation of a compartment type dryer should consider the following items: (1) Operation at different temperatures during different stages; (2) the best schedule for loading the wet trays into the dryer to obtain the shortest cycle; (3) the optimum size of trays for loading and handling purposes; (4) the location of the dryer with respect to the prior operation; and (5) any combination of compartments whereby duplication of instruments or equipment may be avoided. These considerations would be dependent upon the plant and the process where the dryers are installed.

Success Depends Upon Good Control

The problem of automatic controls will be a function of the desired uniformity of drying conditions, the desired product quality, and the decision of the management regarding additional investment in an operation which may be only temporary in nature. However, it is important to stress the following fact: *The success of a food drying operation depends in a large measure upon the close control of temperatures and humidity conditions throughout the drying cycle, and because of the importance of good quality in the final dried food to those who will ultimately consume this food, no expense is too great to make the product as fine as possible.*

In conclusion, for the production rate involved it might conceivably have been justifiable to select a continuous dryer. However, the method of design was the chief purpose of the problem. Many additional factors should be considered in the final design, some of the more important being: (1) Materials of construction; (2) type of insulation to use; (3) loading schedule of compartments; (4) the decision as to whether or not blanching should be done in the dryers; (5) a selection between placing the trays on shelves in the dryer or placing them on trucks which in turn will be placed into the dryer; and (6) possible methods of increasing capacity if the need arises.

OPA to Issue Weekly Figures On Percentage of Yearly Heating

A plan has been worked out for the release of information to newspapers throughout the fuel oil rationed area by the OPA fuel rationing division, showing the percentage of the year's total heating requirements that have elapsed at the date of publication. The primary purpose of this information is to assist consumers in budgeting their ration throughout the heating year.

In order to make the information as simple as possible, it has been decided to release a figure showing the percentage of the year's total heating requirements which have elapsed, rather than to indicate the number of degree days which have accumulated, and a simple formula has been worked out whereby newspapers will be provided with a percentage each week for every weather station in the rationed area.

It is highly important from a standpoint of consumer guidance that uniform information be issued from all sources. The consumers should not be confused by various conflicting percentages which find their way into the newspapers, OPA said.

Degree days are based on 60 F rather than the customary 65 F for use in computing this percentage, because the lower figure reflects more accurately the rate of consumption under rationing. Most consumers, at least those who are most concerned with proper budgeting of their fuel oil rations, have been forced to reduce internal temperatures on the average of about 5 F from normal. Such temperatures may be maintained by the consumption of fuel at a rate more nearly in accord with the accumulation of degree days based on 60 F rather than on 65 F, OPA explained.

The degree days for the current season are employed in the formula for the period preceding the date of the release. The remainder of the season is estimated to be normal. The United States Weather Bureau has assured the OPA that the normal is the best estimate of temperatures likely to prevail in future months regardless of the type of weather that has occurred in previous months. Therefore, on any given date, the total number of degree days likely to accumulate during the entire season can be more accurately estimated by replacing normal degree days for the period already elapsed by the actual number of degree days that have currently occurred. The number of degree days for the remainder of the season, however, is still assumed to be normal.

OPA Denies Fuel Oil Dealer's Appeal

The appeal of a Philadelphia corporation from a suspension order limiting its operations as a fuel oil dealer for a specified period was denied by the hearing administrator of the Office of Price Administration, OPA said in an announcement October 25.

In a decision, the hearing administrator found that the corporation, a large supplier and distributor of fuel oil in the Philadelphia, Baltimore, and Washington areas, had failed to obtain ration coupons from its purchasers and had also failed to turn in to OPA's control and audit section exchange certificates covering 155,000,000 gal of fuel oil. The effect of such violations of the fuel oil rationing regulation was termed "detrimental to the consumers involved, to the general public and to the war effort itself."

Among other things, the affirmed suspension order prohibits the corporation from acquiring any new accounts until May 31, 1944. The respondent has been operating under this restriction since August 1.

Floor Heating System in Hangar Conserves Metal

J. K. Fairbairn and John D. Dillon Describe Radiant Heat Method Using Nonmetallic Ducts Circulating Warm Air Heated by Steam

Radiant Heating

There are many variations on the theme of radiant heating. Pipe coils in the floor, the ceiling, or in some cases the walls may be used to circulate steam or hot water. There are possibilities with electricity as the heating means. Warm air may be used to heat various types of ceiling or floor construction.

On the project described here—a hangar—warm air supplied from coils heated with low pressure steam is circulated through cement-asbestos piping or ducts in the floor construction in order to heat the floor slab. The authors discuss the thinking leading to the selection of this radiant heating system, and describe the savings in metal and other advantages achieved.

In the expansion program of a large naval base, the heating and ventilating design section of Giffels & Vallet, consulting engineers, was called upon to lay out (as occasion demanded) steam, vapor, vacuum, single or two pipe hot water, or warm air heating systems in order to suit the conditions of the innumerable types of buildings comprising the program. In general, picking the type of heat to suit the building was a very simple matter, since the construction in most cases was standard and the use of each building was conventional. The buildings which offered the most difficulty, from the heating man's viewpoint, were the hangars.

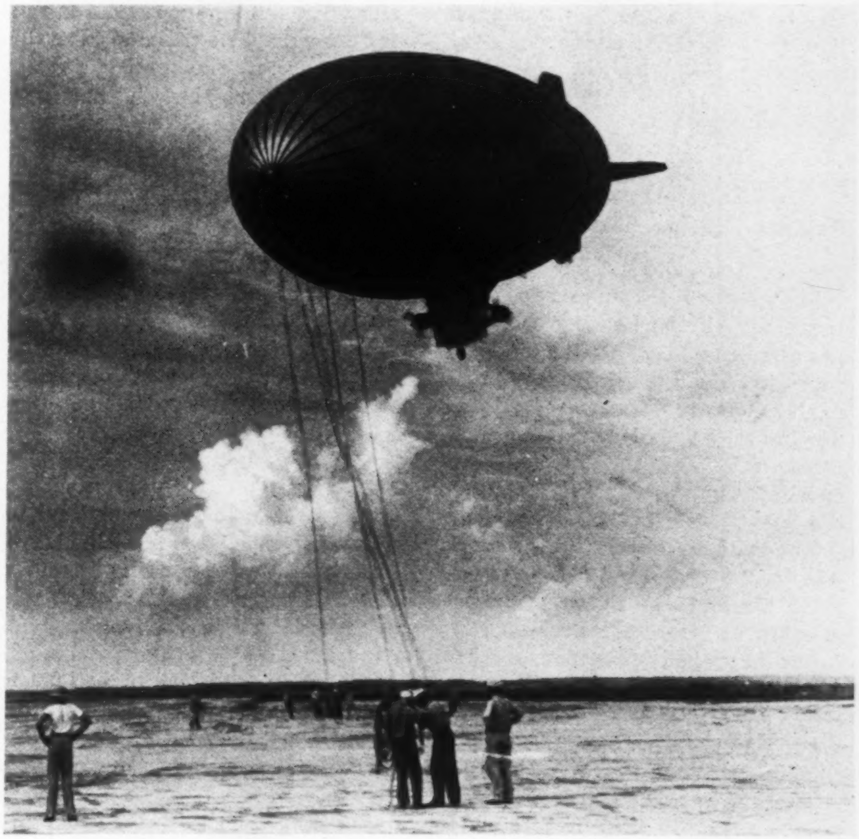
Difficulties in Heating Hangars

The conventional method of heating hangars is by means of vertical flow steam unit heaters hung in the trusses, or floor type unit heaters with recirculating ducts returning the air to the heater from the ceiling spaces. Both these systems of air circulation present certain disadvantages. The vertical flow sometimes fails to reach the floor when the hangar is crowded, since the wings present a very effective barrier. The horizontal flow from the floor type heater sometimes fails under the same conditions because of the obstruction offered by the fuselages. Since hangars may vary from 150 to 300 ft in width, it is apparent that the distribution of heat at the floor is a major problem.

The structural and use characteristics of such a building are such that the advantages of a warm floor slab are easily apparent. The necessary wide span requires a somewhat lofty roof, where heat is not needed, since the work is at the floor. The floor is unbroken by any obstructions, such as machinery or machinery foundations or any necessary services. There is one unbroken space in which there are no fixed positions of work, so that wide and uniform distribution is essential.

The problem of the doors is an ever-present headache, too. Opening a hangar door is just like tearing the side off the building, and many systems have been designed to offset or prevent the inrush of cold air. Most of these have been curtains of high velocity heated air which automatically blanket the opening when the doors are thrown back.

After considerable study of this particular project by the authors, and much consultation with the



The ground crew at a naval air station seizes the handling lines of a Navy patrol airship to assist in landing the huge anti-submarine craft. (Official U. S. Navy photograph.)

structural department, it was decided that a radiant floor slab heating system would have many advantages. A very pleasing development occurred when a cost estimate showed that it was also lower in cost of installation as compared to the other methods considered. The naval authorities in charge of construction were most receptive to the idea of anything that would improve the job, and enthusiastic about anything that would lower the cost. When they saw both advantages presented to them in a single job, permission was immediately forthcoming to install a radiant heating system in a hangar.

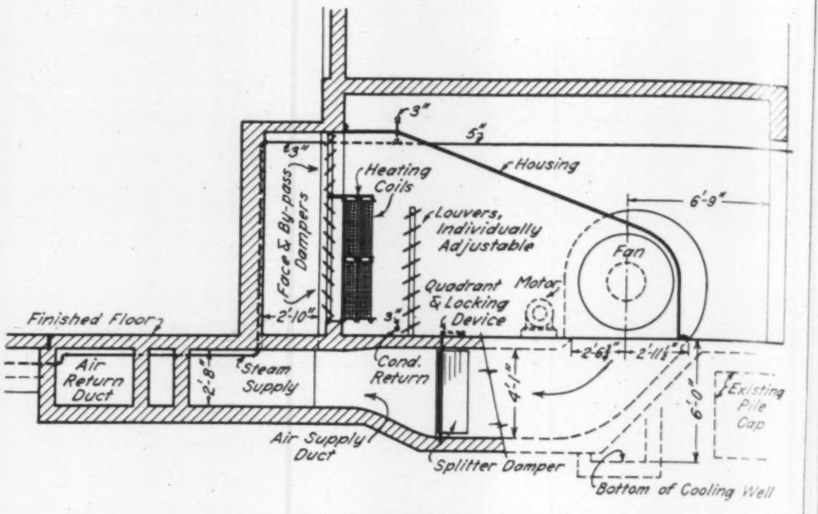
Design was started at once on a system of hot water coils in the floor, with the water heated by steam from a central plant. The hangar was to be built from a standard set of architectural and structural plans, and construction was going on while we were designing. The design was completed just about the time of publication of a list of restricted materials by the Army and Navy Munitions Board. We found, on checking the job for materials used, that the radiant job would use about 8 tons more metal than a unit heater job for the same hangar. Even though the cost of the radiant job was estimated to be about two-thirds of the cost of the unit heater job, the latter was selected for installation on the basis of the weight of metal saved.

Radiant Heating Using Warm Air

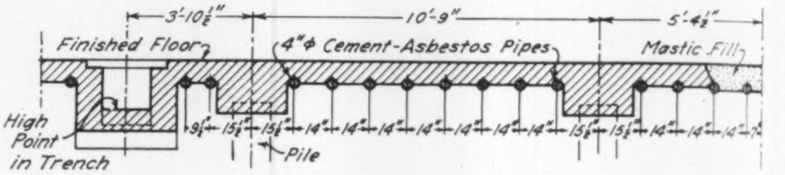
Since the authors had successfully installed a radiant floor job using air as the heating medium, permission was requested and secured to redesign, using a system of ducts under the floor. Before this design could be completed, the construction of the hangar was finished and the floor was poured, the unit heater job being installed.

The radiant heating design work was by no means wasted, however, since the data gathered were applicable to any standard hangar. As it happened, the next hangar was not standard, but we were able to use our material to great advantage, and to shorten the design time.

The subject hangar is approximately 400 ft long by 220 ft wide, with leanto structures 35 ft wide absorbing part of the space on each side. The main hangar floor is thus 150 ft wide. The original intention was to heat the entire job by radiant means, but it developed that the leanto sections would have considerable machinery, and we had no information as to its location. It was therefore decided to heat only the hangar floor with the radiant system, and to take care of the leanto wings by means of convection heating. This decision eliminated the necessity of adjusting the duct system to accommodate machinery foundations.



SECTION THRU FAN ROOM



SECTION

Duct System Under the Floor

The system as finally developed consists of concrete supply and return air trenches on each side of the hangar proper, with the underfloor duct system between the trenches. The supply trenches furnish air through vertical ducts and registers to the leanto sections as well as to the floor system. The returns are collected from the leanto through registers near the floor in the exterior walls, and taken by concrete trench to the main return trench for the hangar floor. Both returns are taken overhead through wooden duct to the fan room.

The underfloor duct system required much study. Tile, concrete, and fiber ducts were considered, priced, and installation costs estimated. Tile and concrete were ideal from the standpoint of heat transmission, but in the 4 in. size these were available only in 1 ft and 2 ft lengths. The expense of wrapping the almost innumerable joints to prevent seepage of concrete, as well as the difficulty of keeping the tile lined up during the pouring of the floor, caused us to look further for our duct work. Fiber was rejected because of expense and resistance to heat transmission. We finally settled on a cement-asbestos pipe which was available in a standard length of 10 ft, and which was supplied with a coupling of the same material. This pipe has a heat transmission factor one-quarter as high as concrete, which made its ¼ in. walls equal in resistivity to 1 in. of concrete. This resulted in a slightly larger temperature drop from the air to the surface of the floor, which was compensated by raising slightly the air temperature under the floor.

The width of the hangar floor meant that the run of duct would be long, and that the temperature drop along the run would be high. The indicated high temperature drop suggested return bends under the floor, in order to equalize temperatures across the floor. This meant, however, an approximate doubling of the run, and in the 4 in. duct the friction rapidly mounted to a forbidding figure. Moreover, the drop in temperature would increase with the added length of run, and the large drop would force us into an initial temperature too high for comfort.

Heater Rooms and Fans

Two heater rooms were installed, one on each side of the hangar. The air heated on one side is blown under the floor through a multiplicity of ducts, and collected on the other side in a return duct, which is reversed to equalize the friction. This return duct is carried to the suction side of the fan in the second heater room. Here the air is reheated, and blown back under the floor through a second multiplicity of 4 in. ducts which alternate with the first. Thus the flow of air in adjacent ducts is in opposite directions, and the warm end of one duct is adjacent to the cool end of the next duct. This design accomplishes the necessary equalization of temperatures across the floor, holds the initial temperature down, and keeps the fans to a reasonable size. In another type of floor the runs could be shortened to achieve better results, but this particular design was limited by the wheel loads of the large planes. Distribution duct work under the floor would have been costly in construction, would have used more steel, and would probably have delayed construction, which could not be permitted.

There are several factors affecting the heat distribution with the radiant heating system, which were calculated only on arithmetical averages. One of these is the heat diffusion to be expected from the earth under the floor slab. Another is the distributing effect of the reinforcing steel which is set in the slab above the ducts. Since the position of the steel will vary with respect to the ducts, considerable variance is expected in the heat diffusion caused by the reinforcing. No attempt was made to limit the leakage of heat into the ground outside the building. The amount lost at the ends is negligible, and at the sides of the hangar floor the loss is desirable, since it heats the floors of the leanto wings and materially raises the mean radiant temperature.

Heating the Leanto Wings

The design of the heating system for the leanto wings differs very little from any ordinary warm air heating system, except that no metal ducts were used. The outlets were spaced at regular intervals along the interior wall where no offices were located. The returns were similarly spaced along the outside wall to give reasonable distribution of the air. The returns were placed at the floor, and gathered into one concrete trench, which spills into the main return to the fan.

Several large trucking doors in one leanto needed compensation for infiltration when opened. This was done by means of increasing the duct discharge at these locations, and controlling the discharge by thermostatically controlled dampers in the ducts. When the doors close, the dampers modulate somewhat to maintain an even temperature. When the doors open, the dampers open completely at the inrush of cold air and attempt to blanket the opening. All other openings in this and the other leanto are equipped only with manually operated supply registers.

Steam Is the Source of Heat

The source of heat is low pressure steam taken from the underground distribution system and piped to the heating coils in each heating unit. There are three rows of coils, each equipped with an automatic steam valve.

The control of the system is simple and effective. The flow of steam to the coils is controlled by the temperature difference between the air entering the heating unit, and the air leaving. This differential is raised or lowered in step with the outside temperature. Humidity is added for the benefit of the leanto wings. Each heating unit is separately controlled, and the leanto sections are thus zoned. The large drop in air temperature through the floor prevents one control from interfering with the other.

Advantages of the Heating Design

Under the design requirements the job seems to satisfy every need. The use of metal was reduced to a minimum, since the steam is piped to two places only, and all duct work is nonmetallic. The number of fans and motors was reduced to a minimum, with a definite saving in horsepower. No copper or other nonferrous metals are used except in the electric motors and controls, and in the fan bearings.

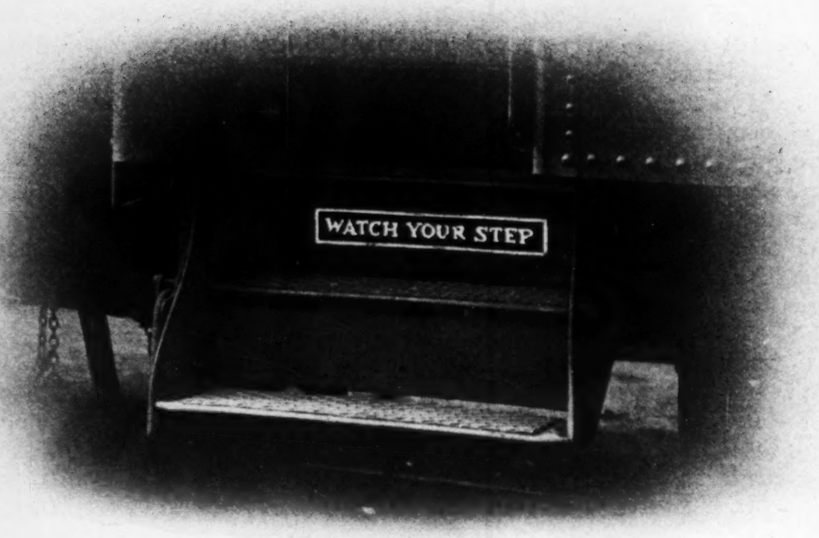
The heat loss calculations of the building showed that we had sufficient floor area to allow us to reduce the interior air temperature, which should result in a saving of steam. The heat is well distributed, and placed where needed; and unless the doors are allowed to remain open for long periods, the door problem is solved by the large residual heat and immediate recovery from the slab radiation.

A cost breakdown showed the cost per square foot of floor space (which is, after all, what the owner is paying for) to be $0.244. The extra cost of trenches in the floor, and all other such costs for work done by the building trades applicable to the heating plant, is included in this figure. The weight of metal used in the heating system is about 10,000 lb.

FUEL COMPUTER USED BY ARMY

The Army has put a slide rule on its winter coal requirements. An ingenious "fuel computer," designed by the corps of engineers for calculating fuel requirements on Army posts, is a circular slide rule using the factors of known floor area to be heated, fuel allowances per unit area, and number of degree days normally occurring in the locality for the season.

The total square feet of floor area on Army posts, including warehouses and hutments as well as barracks, now reaches the astronomical figure of 1,180,243,710.



Refrigeration Industry Has Poor Safety Record

Better Statistics, More Education on Accident Hazards Needed, Says National Safety Council

REFRIGERATION as an industry—which includes cold storage plants, packing plants, ice making plants, etc.—has a poor safety record compared to other industries, and the trend is toward more accidents rather than less as in other classifications. Accidents in the refrigeration industry, however, aren't due to the low temperatures, handling refrigerants, etc., as much as they are to the handling of materials—boxes of goods or cakes of ice falling—and accidents caused by ordinary tools slipping, being dropped, and so on.

The refrigeration section of the National Safety Council met in Chicago October 6, at the Morrison hotel, to discuss accident hazards. Emerson Brandt, general chairman of the section, presided over a gathering that showed increased interest in the problem, perhaps because it has been aggravated because (in the words of one speaker) industry is now employing a lower grade of labor than before due to wartime manpower problems. The safety problem in wartime is also more important, economically speaking, on account of this same manpower shortage.

Vallee Appel, president of the Fulton Market Cold Storage Co., said that the refrigeration industry is well aware of the hazards incidental to low temperatures, machinery, etc., and that it is the "exceptional" or "freak" accident that is responsible for the poor safety showing. There are few accidents, he said, in the machine room; the greatest problem is the education of unskilled labor.

Hazards in Refrigeration Service Work

Safety from the refrigeration service engineer's viewpoint was ably discussed by Myer Axelrod, president of the Chicago chapter of the Refrigeration Service Engineer's Society. Hazards the service man meets are those due to moving machinery, electricity, vapor or hydraulic pressures, and to refrigerants themselves, he said. The hazards presented by refrigerants may be classified as freezing, respiratory, irritant effect of some refrigerants, anesthetic effect or lack of oxygen, and flammability. Mr. Axelrod felt that the most important single warning was to be careful with pressures.

Recklessness—rather than ignorance—is a cause of accidents which must ever be guarded against; he cited an accident several years ago when a service man who knew better, but was in a hurry, used oxygen to test the refrigeration system for air conditioning a restaurant. Oxygen and oil must not come in contact, and the service man paid with his life for disregarding this.

In addition to recklessness, carelessness, ignorance, and mechanical failures represent accident hazards; the precaution to take against mechanical failures is regular inspection and maintenance.

Better collection and better analysis of data on accidents were urged by W. J. McVay of the Bureau of Safety, Chicago. Foot and toe injuries represent the majority of refrigeration industry accidents, he said, and there is need for more work in developing practicable, usable safety devices to prevent them.

Frequent Overhaul and Inspection

J. Edward Middleton, chief engineer of the boiler and machinery division, American Guarantee and Liability Insurance Co., said that the purposes of insurance companies are to prevent accidents and to minimize their results. Insurance companies spend considerably more for prevention than in payment of losses, he stated. He believed it was important to remember always that there is a hazard in the refrigeration industry, and that frequent overhauling of machines and inspection of supports for coils and piping should be constantly stressed. Gas masks should be properly located for quick use and should be in good condition for such use. Relief valves must discharge at points where they don't create a hazard.

Mr. Middleton told of an accident in a fish processing plant, where an improperly guarded ammonia pipe line was run into by a hand truck. Despite the prompt and effective measures taken, the loss amounted to some $14,000. He also mentioned a condenser tube failure in an air conditioning system serving a rayon plant, where the loss could easily have been tremendous.

O. M. Nanfeldt, manager of the accident prevention department of the Employers Mutual Casualty Co., referred to the National Safety Council's booklet of Accident Facts and said "something must be done," for the refrigeration industry shows a definite increase in accident frequency compared with a downward trend for all industries. A better accident reporting system is needed and will help in reducing accidents, Mr. Nanfeldt stated.

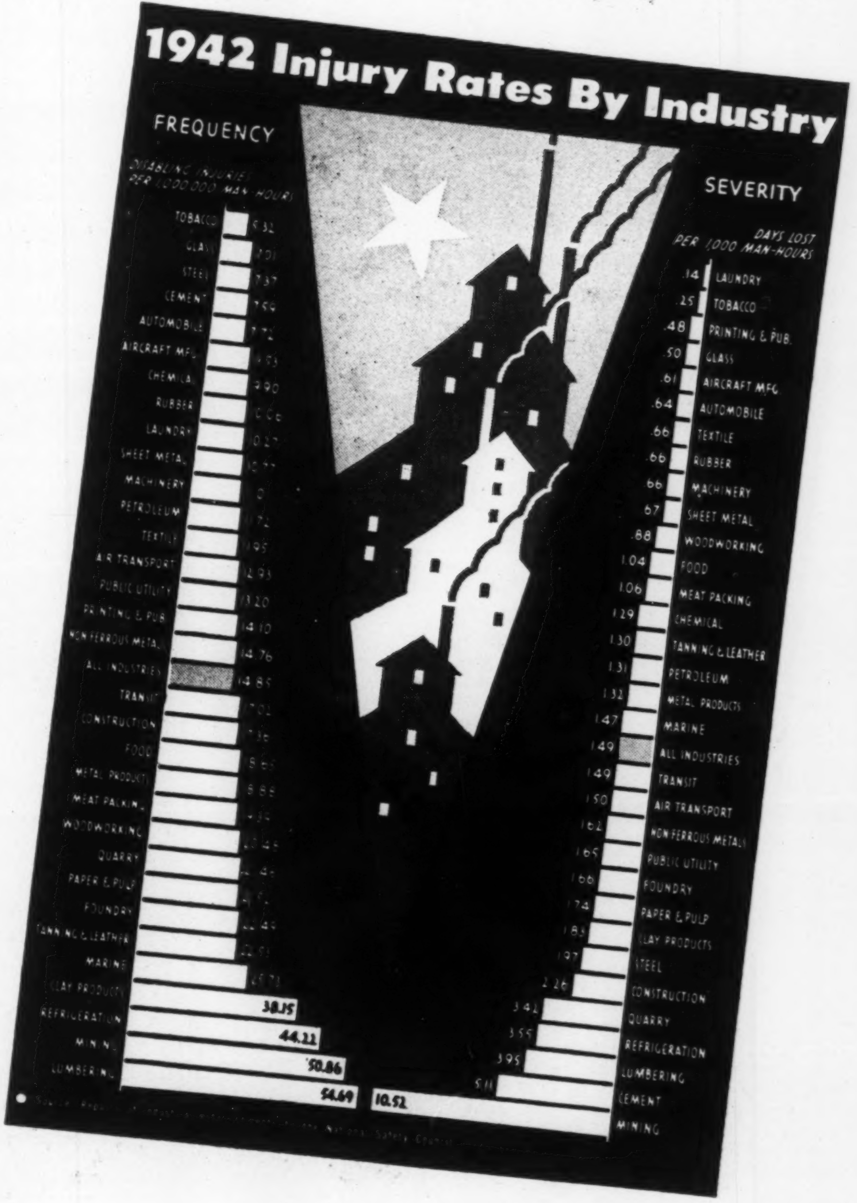
Paul Reed, service manager of Servel, Inc., said that the most effective way to get results in accident prevention is to make one man in the plant or organization responsible for safety. Education in safety, rather than compulsion, is the answer—particularly in view of manpower shortages in all industries.

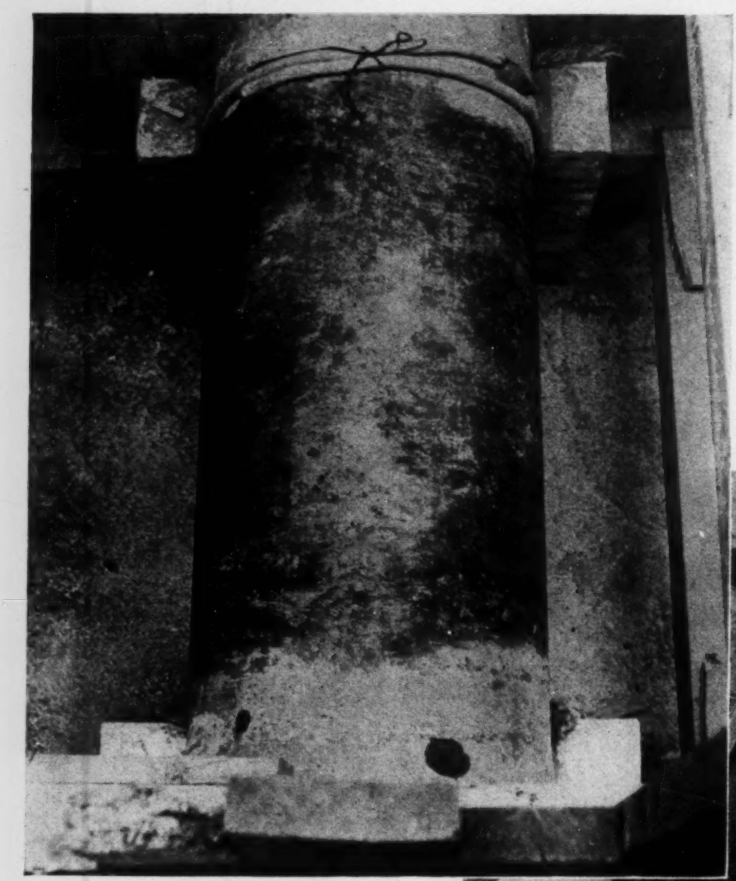
Refrigeration safety problems in hotels were briefly discussed by E. B. Utescher, chief supervising engineer of the Kirkeby Hotels Co. He stressed the importance of cutting off the power when working on refrigeration machines, the necessity of maintaining a tight system, watching out for corrosion, and the value of regular inspection and maintenance. Hotel air conditioning has meant more equipment to take care of; regular attention to and cleaning of motors is a job which should not be neglected.

Refrigerant Changes

The discussion following the prepared talks was largely devoted to conversion from "Freon" to methyl chloride, due to wartime demands for the former. Walter O. Walker, research director of Ansul Chemical Co., said that the recent accident in a Memphis theater was produced by the action of methyl chloride on an aluminum gasket. The refrigerant charge escaped rapidly, he said, probably along with considerable oil in spray form, and since there wasn't adequate ventilation, the explosive mixture ignited when a man—who was killed—entered the basement compressor room. Dr. Walker said that eliminating the aluminum gaskets would have prevented the leak and adequate ventilation would have removed the explosion possibility.

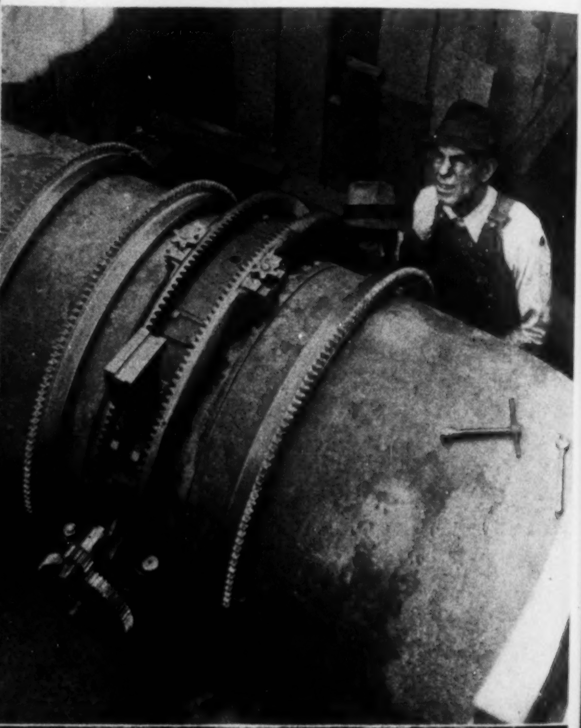
The explosion was a mild one, he said, as evidenced by the small damage done to a large partition of light construction. To the occupants of the building it sounded "like a shot a block or so away."



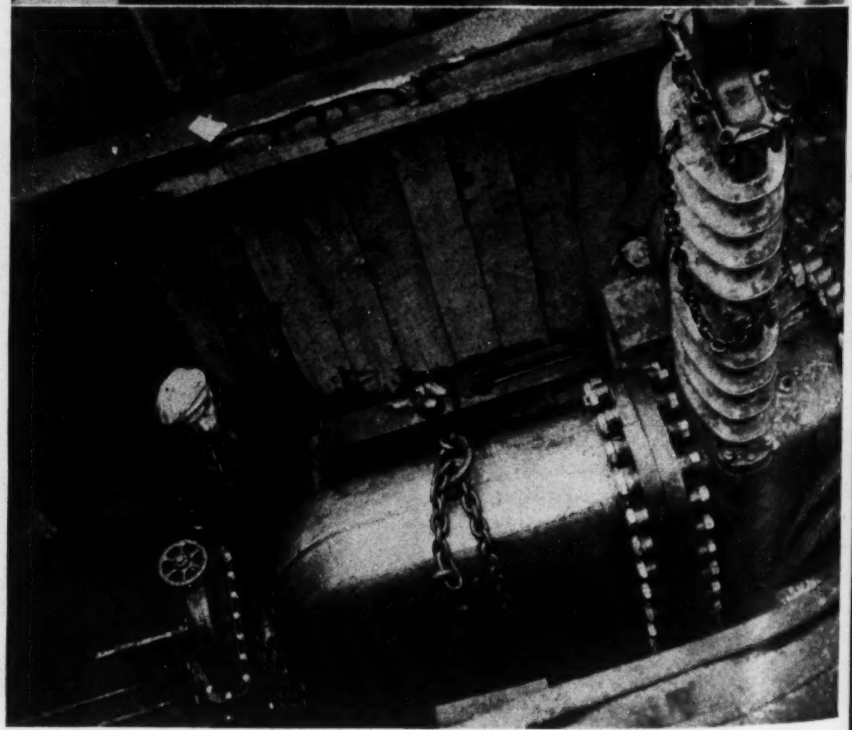


Installing Big Valve in Gas Main Without Interrupting Service

1. Above—Gas main, approximately 3 ft in diameter, after being cleaned of soil and oxidized scale by chipping and scraping. Note the cement foundation installed under both ends of exposed section of pipe—the solidity thus achieved was an important factor in the success of the valve installation

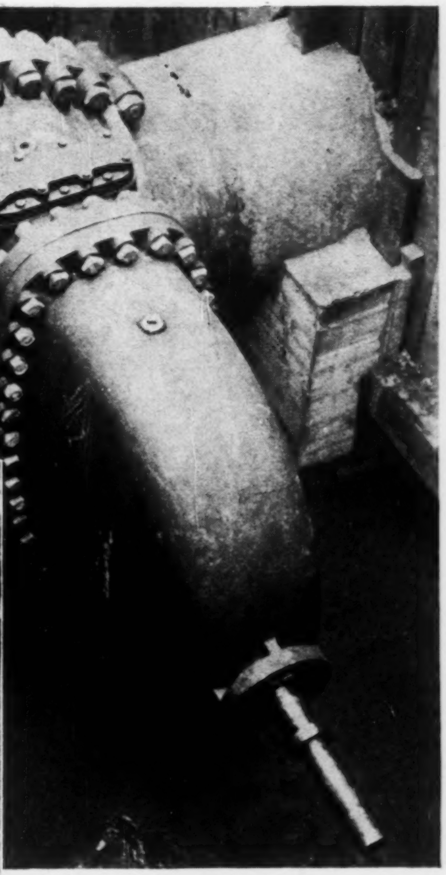


2. Right top—Cutting ring installed on pipe and additional ring gears resting on pipe, to be used in later automatic cutting operation. Note that initial cut has already been made to check operation of cutter. Further cutting is done after installation of air tight chamber which encloses cutting ring and driving gears

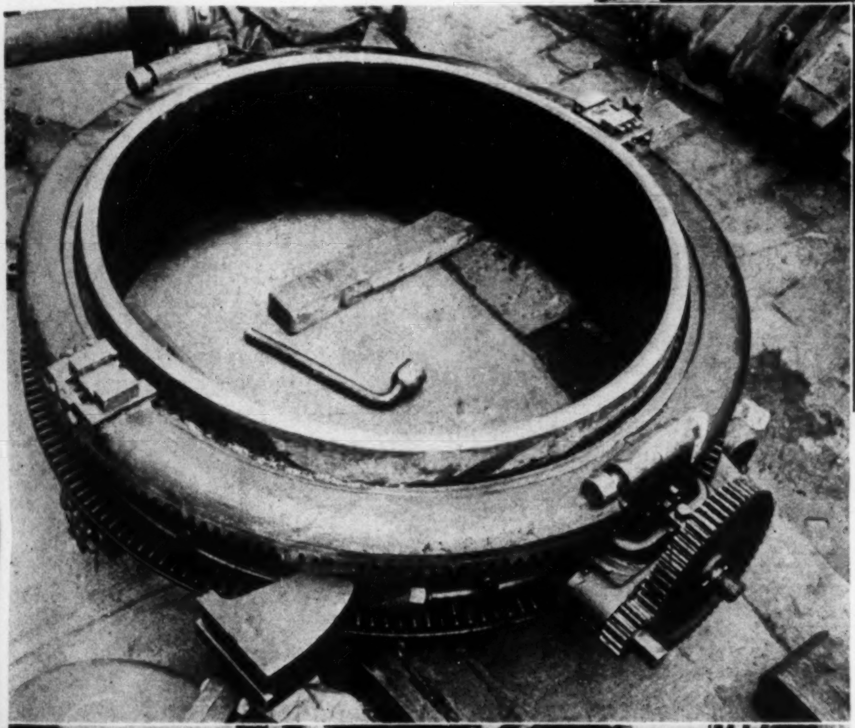


3. Right bottom—Final cutting operation by remote drive; see drive shaft at left. On completion of cut, free section of pipe, with cutting ring attached, is drawn into large chamber at left. Lock gate at top is then lowered, sealing the port between the two large sections, permitting removal of one at left without leakage of gas

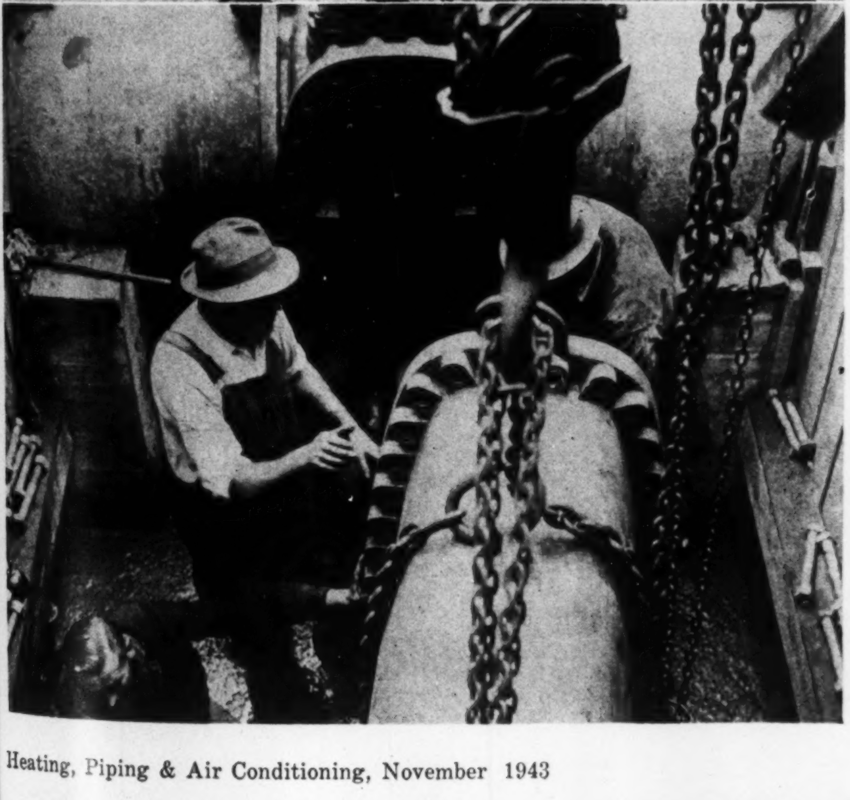
Progressive steps in installation of a valve in a gas piping system where flow could not be shut down. Completed job took about four days (after pit had been dug), with rainy weather most of the time



6. Above—Complete valve installed with exception of gear housing and gears which are not shown and are later attached to the projecting end of the valve stem. This installation was made by the A. P. Smith Mfg. Co. for the Boston Consolidated Gas Co.



5. Left top—Section of pipe with cutting ring attached after removal from detached chamber. Note that lead has been used to center and attach cutting ring to pipe. This use of lead was another important factor in the successful completion of the job



4. Left bottom—Removal of chamber containing cut section of pipe. Note gate locked into place preventing gas leakage from chamber installed around cut pipe. The permanent valve dome containing the valve gates will be substituted for the chamber shown hanging in the picture, and permanently bolted to the body flange shown

Photos by C. B. Hathorn

Draining Superheated Steam Line With Thermostatic Bellows Traps

Is a thermostatic bellows type steam trap suitable for the drainage of a superheated steam pipe line, with steam at 300 psi pressure and 600 F temperature? This question concerning the limits of that type of trap for those particular conditions came up when a reader of HPAC was engaged in designing and preparing specs for a pipe line.

Manufacturers of traps of this type were asked to comment. Following are their replies.

G. A. **Binz**, Sarco Co., Inc.: Thermostatic traps have been made successfully for superheated steam at 300 psi pressure, 600 F total temperature. Trap bodies would be of cast steel and the bellows, and all other interior parts, of stainless steel.

We have made liquid expansion traps for still higher pressures. The body is of cast steel with straight-through flanged connections and flanged strainer cap, for installation in a horizontal line. Tests made on a drip line from a steam main at 700 psi pressure showed perfect operation and positive shutoff with condensate discharging at temperatures from 160 F to 215 F, according to the adjustment setting made. These traps are ideal for service on ships operating at high pressures, since they are unaffected by rolling or pitching of the vessel. This particular type of trap has the advantage that the inlet for the condensate is through the trap valve, which remains closed until the element cools. When open, the temperature surrounding the thermostatic element cannot be more than 212 F unless there is back pressure on the return line. This greatly lengthens the life of the thermostatic element.

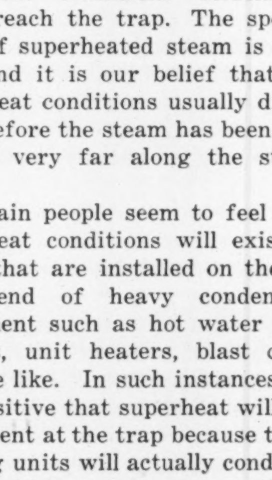
It should be understood that thermostatic traps are not always the most suitable type to use under the conditions of 300 psi pressure and 600 F temperature. They are particularly useful on outdoor applications because they cannot freeze and need no protection against freezing. They are, however, slower in discharging condensation than mechanical traps, which is one reason why bucket traps in forged steel or cast steel bodies, with stainless steel buckets and mechanisms, are sometimes used for this service.

F. O. **Russell**, Trane Co.: The matter of steam traps for high pressure steam under superheat conditions undoubtedly is interesting from many angles. While we do not manufacture thermostatic traps for pressures as high as 300 psi, you may nevertheless find the following comments on heating work of interest.

In certain cases, our high pressure thermostatic traps have been submitted to so-called superheat conditions at high pressure. It is our belief, however, that actual superheat conditions seldom, if ever, reach the trap. The specific heat of superheated steam is very low, and it is our belief that the superheat conditions usually disappear before the steam has been conducted very far along the steam line.

Certain people seem to feel that superheat conditions will exist in traps that are installed on the return end of heavy condensing equipment such as hot water generators, unit heaters, blast coils, and the like. In such instances, we feel positive that superheat will not be present at the trap because these heating units will actually condense steam which cannot occur until all superheat has been dissipated.

The maximum recommended working pressure for our high pressure thermostatic traps is 100 psi gage, although we have in certain cases submitted our traps to pressures as high as 125 psi. We have also produced some special traps employing stainless steel bellows where the steam working pressure is 185 psi. These bellows members are used as the thermostatic bypass in combination float and thermostatic traps.



H. S. **Nicholson**, W. H. Nicholson & Co.: We manufacture a cast steel thermostatic trap with resistance welded bellows, listed in one of our bulletins for a maximum pressure of 300 psi, total temperature 500 F. With any thermostatic trap of the bellows type, the allowable superheat is determined by the safe internal working pressure of the thermal unit. Although we have never conducted actual temperature tests with traps draining superheated lines, we are convinced that superheat rarely, if ever, arrives at a trap which has been properly installed. Thermostatic traps should always be located as far as practical from the equipment drained, and if utilized within the limits of pressure and temperature specified by the manufacturer, no difficulty should be experienced.

E. W. **Rietz**, Powers Regulator Co.: We manufacture a limited line of high pressure steam traps of the thermostatic type. We recommend our standard traps for service up to 125 psi. For pressures up to 150 psi—that is, above 125 and not over 150—we silver solder our monel discs and get very satisfactory performance.

In draining superheated lines (at pressures not above 150 psi) we recommend a long cooling leg which assures satisfactory performance.

N. J. **Shaw**, Barnes & Jones, Inc.: We do not manufacture a thermostatic trap suitable for the conditions of 300 psi and 600 F and, in our opinion, considering the operating and construction characteristics of thermostatic traps, we do not feel that a thermostatic trap to operate under the conditions noted is feasible or practicable.

SAM LEWIS' PAGE

By Samuel R. Lewis
Consulting Mechanical Engineer

Member of HPAC's Board
of Consulting & Contributing Editors

MY FRIEND, Dwight D. Kimball, consulting engineer, has suggested to me that I might say something on this page about plans for averting the depression which experience shows has followed the end of every great war. Mr. Kimball is an unselfish humanitarian, always interested in the public welfare. He has observed the pathetic situation of some architects and engineers who, for one reason or another, have not been swept along by the full tide of preparation for offense warfare. He has been concerned with the problem of absorbing into civilian service the thousands of young engineers now in warfare and with what can be done for the engineers and construction men presently so busy with war plants, who must find employment when the war plants dry up.

I do not doubt but that this country will experience a tremendous civilian construction boom immediately following the war. There is a dammed-up flood of building demand ready to burst as soon as priorities shall be loosened, and as a result of this activity labor costs will probably be high and labor will be scarce for some time. The real test of our stamina probably will be encountered about 10 years after the end of the war, when having built up high prices and easy times (as in 1928) the pile becomes so high that it may topple.

I sympathize with Mr. Kimball in consideration of public welfare, but I have little apprehension of any difficulty before we round out the cycle. When the boys come home I believe that they will be absorbed automatically for many years. We have an increasing population, yet practically no school buildings have been built since the PWA days in the 30's. The public has been well educated concerning refrigerated air conditioning, both for comfort and in industry, yet no private plants furnishing this service have been built for several years, and there will be an intense buyer's market for refrigeration.

Air Conditioning for Future Installation Being Planned

My personal evidence in support of the foregoing statement is that one corporation which has its own office buildings in 10 principal cities has ordered complete designs for year around air conditioning to be in readiness for three of the buildings not already equipped.

As I wrote the above sentence another corporation telephoned for advice concerning consolidation and modernization of all the old toilet and washrooms scattered throughout its large factory. The apparent conclusion is that even though the old fixtures temporarily may be reset, drawings and specifications are to be developed covering the complete modernization of these facilities.

I have the designs all worked out, with costs therefor all paid, to cover year around complete air conditioning of one of the largest office buildings in Chicago. Almost daily I am called on to guide the various small maintenance construction jobs in this building and to watch the tenant changes throughout so that this ultimate, very extensive project may proceed smoothly.

I received this morning a contract to conduct research for and to design means to reduce the losses on account of imperfect coating of candy bars which will occur next summer. This is a long-pull problem dealing with refrigerated air in an enormous confectionery plant.

By Request

On this page, Mr. Lewis comments informally — at the request of the editors of HPAC—on a few of the problems he has met and is meeting in his wide experience as a consulting engineer engaged in heating, piping, and air conditioning work. Some of the time you'll agree with him . . . some of the time you may not . . . but you'll always find his remarks interesting and thought-provoking.

This month, he writes of planning now for postwar projects, and expresses the thought that there will be a tremendous civilian construction boom as soon as it is possible for wartime priorities and restrictions to be loosened. He concludes with his experience in pulling through the last depression, giving credit to his life insurance for keeping his organization together during those difficult years.

I lived through the depression of the 30's without quite reaching bedrock and without turning any of my employees out to walk the streets. I work on the old fashioned idea that a going business owes a personal responsibility to the people who help make the business and that this responsibility should not be turned over to a "New Deal." Hiring and firing floating labor is one of the great sins of many big corporations. My accomplishment was possible because, having only five employees, I could expend my capital to support them and their families for an extended period.

Life Insurance Carried Me Over

My business survived because after all my savings invested in stocks and bonds had been sold or hypothecated at tremendously deflated prices, I still had a considerable back log in the cash value of long-carried straight life insurance. It was the cash value of this life insurance which carried me over the pit of the depression and which enabled me to retain my good assistants and with their aid to make a very rapid recovery. My life insurance was the only investment I had which did not shrink. Due to its stability I was able to avoid mortgaging my home, to prevent losing my good men and to save my business.

Today there are hundreds of competent engineers working at inflated salaries in temporary war offense plants. I wonder how many of them carry adequate life insurance?

Coal Is Vital War Material

John Howatt Reviews a Manual of Instructions on Proper Firing Methods for Best Combustion and Suggests Ways to Conserve Fuel Supplies

THE MANUAL of Instructions on Proper Firing Methods in the interest of Fuel Combustion and Conservation, Air Pollution and Smoke Abatement,* published by the Smoke Prevention Association of America, Inc., is an inclusive book covering the field indicated by the title, within whose pages is contained data that will help the consumer to make a proper selection of fuel for his particular plant, advice on the best practical ways of storing coal, advice on the proper methods of firing bituminous coals, and a description of the more common types of automatic stokers. Each of the eight chapters in the book is written by an authority in his field who has joined theory and practice in such a way they can be used to good advantage. Its publication last month has inspired the following remarks on coal and its combustion.

Spontaneous Combustion

With the different government agencies stressing the importance of maintaining an all year 'round flow of coal from the mines to the consumer in order to spread the labor and transportation loads, the study of the different methods of storing coal, combined with an explanation of the methods to be adopted to prevent spontaneous combustion, is most timely. Since spontaneous combustion in stored coal piles is caused by a union of the elements in coal with oxygen at a rate high enough to raise the temperature of the coal pile above the ignition point, preventive measures are based upon arrangements for keeping the temperature of the coal pile low or for cutting off the air flow through the pile. Since certain combinations may set up chemical reactions with the production of heat, coals that carry such combinations should be avoided for storage piles. The finer sizes of coal, too, are more likely to burn in storage because the finer the particles of coal are the greater is the surface exposure to the air per pound of coal. For this reason, coal piles consisting of lumps seldom overheat, while coal piles containing much slack and dust must be watched closely and have temperatures taken frequently.

How Evaluate a Coal?

When one government agency established floor prices for coal at the different mines (price levels below which coal could not be sold) and another government agency established ceilings setting price levels above which coal could not be sold, neither limitation adequately taking quality into consideration, the purchase of coal on quality specifications entered into a difficult period. Since coal is purchased in order to produce sensible heat, the proponents of buying coal on its heat value basis alone have had in the past a strong argument in their favor; and since the heat value of moisture free coal varies almost inversely with the ash content, the percentage of ash in dry coal can be a rather dependable index of its heat value.

However, there are many physical factors that must also be considered in determining the best coal purchase to make. Consideration must be given to the storing qualities of the coal, its coking qualities, whether or not it is free burning, whether or not there are foreign elements in the coal that will lead to excessive smoking or clinkering. Much can be learned by laboratory analysis, but it must be remembered that coal is a heterogeneous mixture rather than a homogeneous material; since that is the fact, samples of coal from the same mine will not all test exactly the same. A compilation of many samples, however, will establish an average analysis for the mine which other samples should repeat within 10 per cent. This indicates a danger in placing all dependence upon one sample of coal in passing final judgment on all of the coal from any particular mine. The error is reduced in proportion to the number of proper samples taken and analyses made.

Of importance, too, in the selection of coal by the consumer is the care with which the mine operator prepares his product both as to sizing and as to picking, which consists of the removal of stone, slate, or other foreign material that depreciates its value. The better operators maintain an engineering service for the benefit of their customers, such engineering service being intended primarily to help in the sales of the product through the creation of goodwill with the customers. They also see to it that the size and kind of coal is being furnished that is best suited for the plant, and when that is done then diplomatically correct any wrong boiler room practices that affect efficient use of the fuel. Such engineering service by the fuel supplier can be of great value to the consumer.

Fight Waste!

Conservation of our fuel supplies in wartime is so important a subject that, instead of reviewing the Smoke Prevention Association's new manual on proper firing methods briefly in the "back of the book," we asked Mr. Howatt to go into the subject in some detail and use his review as a "springboard" from which to get into a fairly comprehensive discussion. His practical comments on the fundamentals of combustion and firing methods will be of particular interest to all who buy and use bituminous coal for heating.

Mr. Howatt is chief engineer of the Chicago Board of Education, chairman of the ASHVE's war service committee (which has developed a comprehensive fuel conservation program), and a member of HPAC's board of consulting & contributing editors.

---

*Price, 25c. Address of the SPA is 139 N. Clark St., Chicago.

Uncle Sam
wants YOU
to fight...
WASTE!
Save Fuel –
by Heating Efficiently

Selecting the Proper Stoker

The chapters of the SPA's book devoted to stokers cover the underfeed stoker, the chain grate stoker, and the spreader stoker, all of which are in common use in plants of all sizes today. The subject matter is free of anything that could be called promotional advertising for any particular make of stoker and each covers very thoroughly a general description of the principle involved in each, a description of the general design features, and excellent care and operation advice. However, the authors do not point out the weaknesses of the different types nor do they point out the limitations for their use. Every engineer knows that some plants are best suited to one type and some to another. Engineers know that any of them will give satisfactory operation under some sets of conditions and unsatisfactory operation under others. For example, one type can operate using coal having ash or clinkering characteristics of such a nature that the coal could not be successfully used on one of the other types. It is known, too, that some types of stokers are more quickly adaptable to changing loads than others and some more suitable for carrying large overloads satisfactorily. The proper furnace design and the proper size of stoker for the load is important regardless of what kind of stoker is chosen.

Since the manual is published under the auspices of the Smoke Prevention Association, it would seem fitting that the conditions of operation under which each of these types of stokers will cause excessive smoking be pointed out. No one has the right to operate a plant that is a nuisance to his neighbor. A smokeless stack does not necessarily mean efficient operation, but a smoky stack does indicate a plant that is likely operating below its maximum efficiency. Smokeless combustion of fuel under all conditions that may be met is a matter of determining proper factors in choosing the type and size of stoker, the furnace design, and the size and kind of coal.

Too much attention cannot be given to a study of draft conditions. What is termed "draft" is the differential in pressure between the under-grate space and the stack. It causes the movement of air and gases from beneath the grates through the furnace and boiler and out to the chimney. It is one of the factors in combustion that is controllable and is most important. There is a relationship between loss in air pressure through the fuel bed, the thickness of the fuel bed, the size of the pieces of coal, the rate of combustion, and the furnace efficiency. When coal of a relatively uniform size is being fired, a standard thickness of fuel bed should be adopted for standard practice and the draft changed to meet the load demands. Under this method of operation the fuel bed remains of uniform thickness and the draft and the rate of feeding coal are varied as the load requires.

The Three T's

For many years combustion engineers have said that good smokeless combustion of coal cannot be had unless the right conditions of the three T's are present—temperature, turbulence, time.

The temperature of the furnace in all parts must be kept above the ignition point of the carbon and gases. Anything that will lower the furnace temperature at any place below this ignition point will bring about a condition that will permit fine particles of carbon and combustible gases to get away, fouling the tubes and passes of the boilers and wasting valuable fuel. Too much air, either through or over the fire, air leaks into boiler settings, badly fitting or burned castings, holes in the fire, and defective settings, all tend to chill the furnace and reduce efficiencies. The furnace design, too, is an important factor in the uniformity of high temperatures throughout the entire combustion space. So much of the furnace temperature is dependent upon radiant heat that the refractory materials must be shaped to take full advantage of it.

Turbulence is necessary over the fire to bring about a proper mixture of the gases distilled from the coal with the available air supply. Without turbulence there will be an excess of air at some points and an excess of volatile gases at others. Turbulence brings about that uniform mixture of rich and lean gases with air that is necessary if complete smokeless combustion is to be obtained. However, a clean stack does not necessarily mean efficient combustion; a clean smoke stack may mean so much air is being supplied that analysis of flue gases will show the CO_2 to be far below the practical ideal of from 12 to 13 per cent and much fuel is being wasted heating the too large air volume.

The gases must be allowed to remain in the combustion chamber long enough so combustion will be completed there. If the gases are whipped out of the combustion space too rapidly, some part of them will be carried into the flue banks and tubes before combustion is complete and will reach the smoke stack in that unburned state. Excess draft will bring this about and will bring about not only inefficiency because of the carrying away of combustible gases but will result, too, in carrying fine ash and fine carbon particles into the tubes and flues, fouling them and adding further to the overall inefficiency of the plant.

Efficient and Smokeless Burning of Coal

Throughout the manual, certain fundamental facts pertinent to the efficient smokeless burning of coal are repeated although expressed in different language in the several chapters. These facts may be summarized as follows:

a) The fundamental rule of perfect and smokeless combustion is the maintenance of a proper mixture of air and gases from the coal in a furnace at high temperature with time enough to complete combustion. Anything that will prevent these conditions will interfere with perfect combustion and tend to cause smoke.

b) The thickness of a fire should depend upon the draft and the size of coal being fired. If the fire bed is too thin, too much air will pass through it and the furnace will be chilled. If the fire bed is too thick, an insufficient quantity of air will pass through and incomplete combustion, probably with the formation of carbon monoxide and smoke, will result.

c) There should be no holes in the fire bed. If there are, the resistance of the fire bed is reduced at that point and large quantities of air will stream through into the combustion space, chilling it and causing smoke.

d) The fire should be kept clean of clinkers and ash; coal thrown on top of large clinkers is shut off from action of air so the gas distilled from this coal passes off without being burned.

e) In order to keep the temperature of a combustion chamber high enough to ignite volatile gases, only a part of a grate should be cleaned at a time, keeping a hot fire on the other. This will provide heat enough to ignite the volatile gases coming from the new coal thrown on the clean side of the grate.

f) If too large a quantity of fresh coal is thrown on a hot fire, gases are distilled so rapidly for a few minutes that air cannot properly be mixed with them.

g) Theoretically, the finer and more uniformly sized coal is when fired, the more perfect will be the combustion because the easier it will be to mix the air and the combustible materials. Gases distilled from a large lump of coal can be mixed with air around the outside of the gas stream only. Gases distilled from the coal near the central portion of the stream pass out without being burned and reduce furnace efficiency. When coal is all of one size draft and proper thickness of fuel bed can be correctly adjusted.

h) Steam or air jets are installed in furnaces to set up a turbulence in the furnace more than for the introduction of overfire air. Some overfire air is necessary for complete combustion but it amounts to only about 10 per cent of the total amount required. Its greatest value is in setting up turbulence that mixes the gas streams from the fuel, mixing the lean gases from coal already coked and the rich gases from green coal newly fired, thus aiding in completing the process of combustion before the gases enter the flue banks. To insure turbulence the velocity of the air or steam jets should be not less than 10,000 fpm, with jets so placed they will be most effective in crossing gas streams.

i) The temperature at which coal ash will fuse is indicative of whether it will form clinkers readily or not. Too much weight has been given to the percentage of sulphur in coal as an indication of probable clinker formation. It may be a factor, but there are others more important such as insufficient draft and unnecessary stirring up of the fuel bed. Excessive stirring of the fuel bed mixes small sizes of coal with ash and subjects those particles to intense heat, causing formation of a clinker that carries with it a high percentage of combustible material. Start with clean coal, do not carry the coal bed too heavy, avoid puddling or stirring as much as possible, and avoid bottling up of the heat in the furnace if clinker formation is to be avoided.

Our government has declared fuel a vital war material and many organizations, including the American Society of Heating and Ventilating Engineers, are actively supporting fuel conservation programs. This manual is a contribution toward this effort that should have wide influence in creating better practice in the selection, storing, and firing of bituminous coal. It adds to the fund of knowledge on the subject and should prove to be a valuable addition to any engineering library.

NO COUPON COAL RATIONING, OPA SAYS

There will be no coupon rationing of coal during the coming winter, Chester Bowles, of the Office of Price Administration, said October 23. The statement was made to clarify the coal situation in the northeast, where many persons normally using anthracite have been unable to obtain deliveries.

OPA AMENDS ANTHRACITE ORDER

Anthracite dealers in 12 northeastern states and the District of Columbia were authorized last month by the Office of Price Administration to give first call in scheduling deliveries to customers having little or no anthracite in their bins.

The action—amendment 3 to ration order 19—is an emergency measure taken to spread the supply of anthracite. The change modifies the original OPA delivery limitation order which provided a system of priorities for deliveries of anthracite and required delivery first to customers having on hand less than one-fourth of the amount they used last year.

OPA AUTHORIZES RADIATION INCREASE

To assure essential production of cast iron radiation, the Office of Price Administration authorized last month a three cent per foot increase in sheet prices of all types of cast iron radiation.

"OPEN FOR DISCUSSION"

Comment on HPAC's articles and other timely topics

Coordination of Dimensions of Building Materials and Equipment

THE EDITOR—

We are on the eve of accomplishing one of the most fundamental programs ever proposed for the construction industry—the coordination of dimensions of building materials and equipment. An industry committee, organized under the auspices of the American Standards Association and sponsored jointly by the American Institute of Architects and the Producers' Council, for several years has analyzed this proposal and now needs the interest and frank criticism of all interested parties in the construction industry.

The proposed American Standard Basis for the Coordination of Dimensions of Building Materials and Equipment, A62.1, establishes a standard module of 4 in. as the basis of coordination of dimensions and the correlation of building plans and details with materials and equipment having standard coordinated dimensions. Methods through which building plans and details are so correlated are being developed by a committee of architects, which will undertake, as rapidly as possible, to disseminate necessary information to designers so that they may understand and support this project. Such acceptance by designers is the first prerequisite to adoption of coordination. Manufacturers generally will undertake to produce whatever is called for and can be expected to be tolerant during the transition period when both the coordinated sizes and precoordinated sizes are in use.

The second prerequisite to adoption of coordinated or modularly-designed construction is for each line of manufacturing to develop its coordinated sizes and make standard modular products available to the industry. Several manufacturing lines are doing this concurrently with the perfecting of the application of coordination to design by the study committees. For instance, there is now being circulated to the sectional committee, preliminary to its release also to the industry for review, document A62.2—proposed American Standard Basis for the Coordination of Masonry—to apply to all types and kinds of masonry units. This is a forerunner to an application standard (A62.3) through which the structural clay products industry will propose standard coordinated brick and tile sizes, and it is expected that the manufacturers of cement products will similarly submit an application standard for their structural units. When the coordination of masonry and masonry unit sizes is accomplished, it will represent one of the greatest advances which the construction industry has ever made. At the same time, other study committees are working on application standards applying to doors, metal and wood windows, and other items.

Pro and Con

Toward the end of most well-run engineering meetings, there is time set aside for questions and answers, and discussions from members of the audience. The editors of HPAC follow the same procedure in print; certain pages are regularly devoted to comment from readers on articles which have been published in our pages, and on other timely topics. Our readers are invited—in fact, requested—to discuss the articles or parts of articles which particularly interest them. Frequently such comments are as widely read as the articles which inspired them. . . . HPAC's editors and readers, and the authors of articles published in our pages, will welcome your views and opinions on the subjects treated each month. Address them to The Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago, 2, Ill.

The executive committee and the various study committees have proceeded to the point where it can be said that it is feasible to correlate building plans and details through the proposed basic standard and fix standard coordinated sizes and dimensions of building materials and equipment through application standards which conform to and are supplementary to the basic standard. While it might be desirable for the designer to be able to review the proposed basic standard (A62.1) with full information at hand on the application standards mentioned, the executive committee is of the opinion that sufficient information is now available and time will be saved by immediate industry review and criticism of the proposed basic standard. Accompanying the proposed basic standard are several explanatory notes especially valuable to the designer and manufacturer in understanding the correlation of building plans and development of coordinated sizes through modular details.

While the construction industry is reviewing and criticizing the means through which basic coordination is accomplished, the study committees will proceed expeditiously to complete their portions of the project. Certain postwar projects are even now being planned on the coordination basis, and it is our hope that a substantial portion of postwar construction will be designed and carried out on the coordination basis, thus making a substantial contribution to better and more economical construction. In order to accomplish this worthy objective, it is necessary that the industry adopt this project with all possible speed. Therefore, I request all professional and trade organizations, and individuals, to examine the proposal, ask questions, and give this industry committee the benefit of their criticism.

Comments and questions should

be addressed to M. W. Adams, secretary, ASA committee A62, % Modular Service Association, 110 Arlington St., Boston 16, Mass., who will undertake to assist organizations and individuals to obtain the information requested and thereby further a thoroughgoing discussion and review of this important project. Copies of the proposed American Standard Basis for the Coordination of Dimensions and Building Materials and Equipment (A62.1) may be obtained by application to Mr. Adams.—MAX H. FOLEY, chairman, ASA committee A62; Voorhees Walker Foley & Smith.

Decentralized or Centralized Air Conditioning Systems?

THE EDITOR—

It is, of course, quite a temptation to analyze point by point the comments by H. M. Hendrickson published in the Open for Discussion section of the September HPAC, pp. 456-458. I think you will agree, however, that this sort of debate could go on indefinitely, and that it would serve no particularly useful purpose. It is my belief that, for a reader to have a constructive understanding of the various issues, he would be required to spend several hours reviewing the original papers and the refutations which grew out of them.

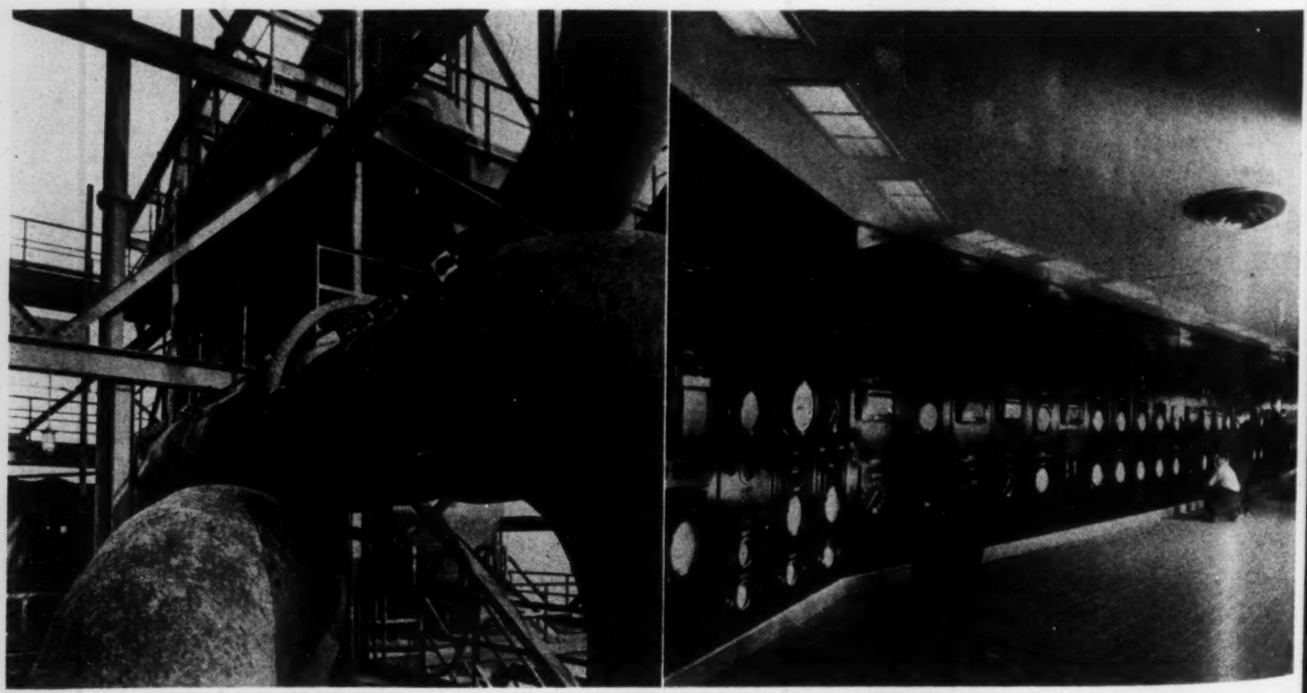
Doesn't this boil down to a generalization which is true of almost every type of air conditioning? That is to say—no one type of system is the ideal solution for all applications. Not only are a large number of economic factors involved, but the choice may well be dictated by expediency. Mr. Hendrickson has clearly presented this angle in discussing the Douglas plant, where he states that it was doubtful whether large central station refrigeration equipment could have been obtained and installed quickly enough to keep up with the building schedule, whereas small refrigerating units were available in the time allowed. In an emergency, of course, there is sound reason for the expedient thing.

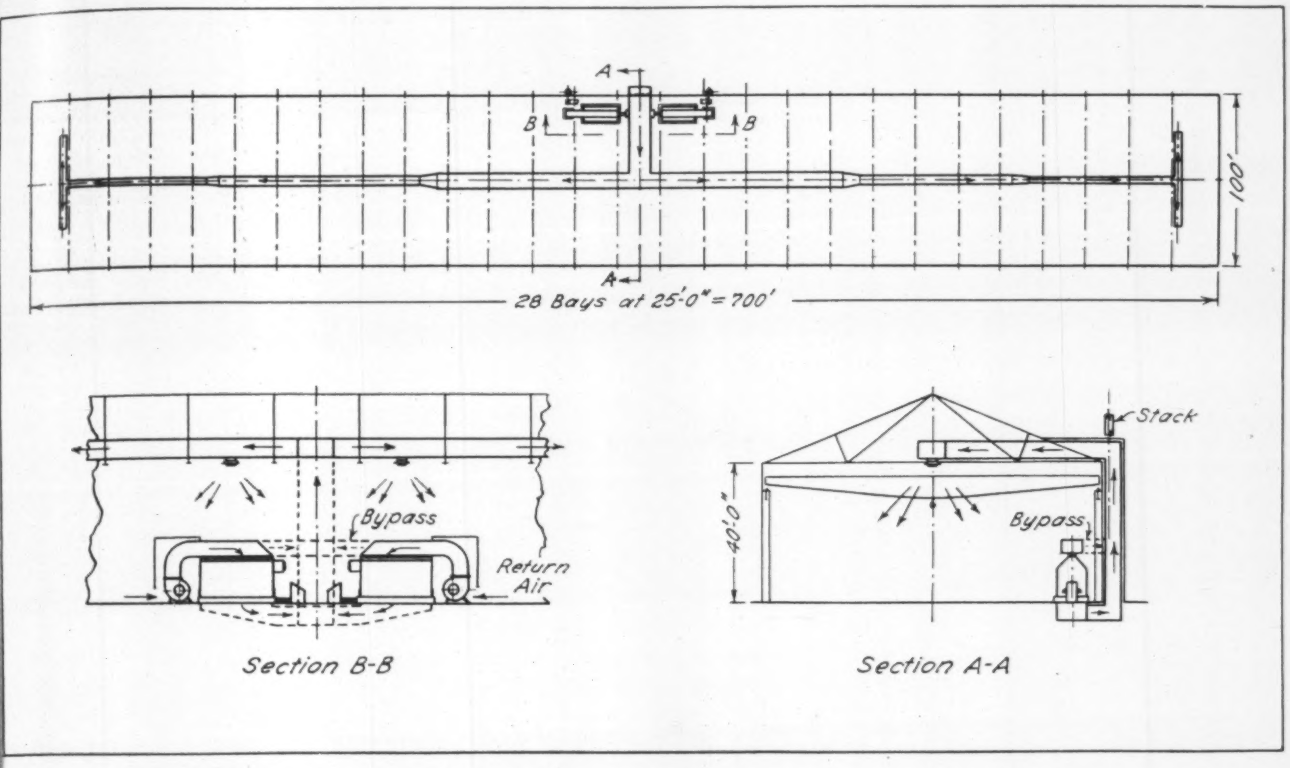
I do hope that these discussions have stimulated interest among some of the men who are members of the engineering firms who designed these various war plants, and also among the supervisory personnel who are responsible for the operation of the air conditioning systems in the plants. These men have a different, and probably more realistic, point of view than those of us who are in the manufacturing and contracting end of the business. I am hopeful that some of them will come forward and give us the benefit of their thinking in adopting the particular designs which have been used, and the benefit of their experience in working with them in actual operation. Such points of view should not only be informative and interesting, but should also lay a factual groundwork on a subject which is more greatly in need of facts than opinions.—W. A. GRANT, director of application engineering, Carrier Corp.

PIPING AND INSTRUMENTS AT FLUID CATALYTIC CRACKING PLANT

Two views of a fluid catalytic cracking plant at a refinery of the Standard Oil Co. of New Jersey. At the left are seen catalyst and oil lines backed by cyclone separators for recovery of catalyst. The expansion joint on the upper line is surrounded by a pipe filled with inert gas which feeds into the joint at higher pressure than the catalyst stream, thus protecting the bellows from the catalyst. The picture at the right shows the control room, where temperatures, pressures, and rates of flow are automatically registered and recorded for the whole unit.

(Photos courtesy Foster Wheeler Corp.)





Heating Industrial Buildings With Direct Fired Air System

D. Henderson Suggests Methods of Reducing the Heat Requirements and Shows a Typical Example of This Type of Industrial Heating

It is unusual to put up a building of corrugated sheet iron construction with the object of heating it uniformly and comfortably. When such heating is involved, some measure of insulation or some other material is used in the construction, with particular attention being given to the roof. However, there are many steel mill buildings of corrugated construction that were not built with such heating in view and there is now an increasing demand for heat in these buildings.

Much can be done to reduce the heating cost by careful analysis of the heat requirements and proper selection of the heating equipment to suit the conditions. For example, consider the corrugated sheet iron mill building shown in the sketches. Arbitrary dimensions—700 ft length, 100 ft width, and 40 ft height to the lower chord of the truss—are given. It has 64,000 sq ft of wall area, a little over 75,000 sq ft of roof area, and contains 3,500,000 cu ft.

Temperature Differential and Air Change

The temperature differential is the difference between the inside temperature near the floor level and the outside temperature and is the basis for estimating the heat loss. Consideration should be given to a 40 F differential, to reduce the heating requirements. At a 40 F differential, and with a maximum inside temperature of 55 F aimed for, this maximum temperature will be maintained until the outside temperature drops below 15 F, and at 0 F outside, the inside temperature will be 40 F. However, considering the mean temperature for the coldest month, going below a 55 F inside temperature will not occur very often in most localities. In most cases an occasional drop as low as 40 F inside should not hamper operations. If an arbitrary 60 F differential were figured, it would require a 50 per cent larger heating plant and 50 per cent more fuel, an extra cost that would necessitate careful justification.

The number of times per hour the volume of air in the building changes is a big factor in heat loss calculations. For example, one air change in the building under consideration involves a loss of over 3,000,000 Btu per hr based on a 40 F temperature differential between indoor temperature at the floor level and outdoor temperature, and allowing for 10 F temperature difference inside between the floor and roof levels. Therefore, air change should be studied carefully. The volume of the building being 3,500,000 cu ft, one air change means a loss of air at the rate of about 60,000 cfm. Unless the operations carried on in the building result in air contamination, a fraction of an air change per hour should be sufficient for proper breathing conditions. A building leaking air at the 60,000 cfm rate implies that the total area of all points of leakage should be about 600 sq ft based on 100 fpm leakage velocity. This, plus 600 sq ft more for makeup air, makes 1200 sq ft of opening. It will be apparent that a building of this sort should be tightened up if at all possible.

Then, there is the ventilation required to offset air contamination by the operations carried on in the plant. The various departments of a steel plant require varying degrees of ventilation and the steel mill engineer should be the best judge of how much. The incentive to reduce this to safe limits should be what one air change per hour means in heat loss. In our case, as stated above, it is over 3,000,000 Btu per hr, equivalent to over 90 boiler horsepower.

The primary aim should be to use, wherever possible, controlled ventilation as against wide open monitors or undampered ventilators on the roof. With control, the ventilation can be throttled down for winter operation. If the source of contamination is, for example, at one end of the building the ventilation should be concentrated at that point. This means less air vented.

Heat Loss Through the Roof

Usually the biggest loss is through the roof because of its area and because the inside temperature is highest at this point. Every effort should be made to keep the temperature difference between the floor and roof levels down. It should be practicable by using good heating practice to keep this differential within 10 F. In the building sketched here, the roof loss, based on a 10 F difference between floor and roof and a 40 F differential between inside floor level temperature and outdoors, figures 5,650,000 Btu per hr. If the difference between floor and roof level temperature were 20 F, the roof loss would be 6,780,000 Btu per hr. This illustrates much can be saved by keeping ceiling temperatures down. Applying insulation to the existing roof covering may also be justified; if the loss by doing this is cut by a third, this would mean a saving of almost 2,000,000 Btu per hr, based on a 10 F difference between floor and roof level temperature. The saving of fuel and initial cost of the heating equipment may well justify the cost of applying such insulation.

The heat loss tabulation given below shows how the figures pile up as the factors are increased. The figure for the insulated roof is based on the above-mentioned saving of one-third.

Direct Fired Heating System

Considerable impetus has been given recently to the direct fired method of heating, using coal as the fuel. Some of the installations are notable in size, one project alone having 117,000,000 Btu per hr installed capacity in one building. There have been new developments in the art along the lines of large capacities in single units, all steel heaters using radiation and convection heating effects, and simplification of the air distributing system.

The heating layout shown in the sketches involves two stoker fired air heaters, two fans, and a duct system. The heaters are shown inside the building on the assumption that space is available there; they can just as well be placed outside in a leanto. Inside, the travelling crane could possibly be used for coal handling.

The duct system consists of a header only, resting on the lower chord of the roof truss. The warm air is discharged to the floor through a multiplicity of high velocity air diffusers, which act to diffuse the warm air with the room air quickly and to flare out widely the flow of air to the floor all in such a way as to cause little or no draft. Compared to a duct system with downcomers, this method costs less and is not subject to damage. The riser from the heaters to this header is placed outside and suitably insulated and weathered. There is thus no interference with the crane. Nonmetallic materials may be used for the ducts to save critical materials.

"One World"

Building construction, building insulation, use of the building, the ventilation requirements and many other factors all add up to "one world" for the heating engineer, who must consider all these and many other points in order to design and specify the right heating system. Mr. Henderson—engineer in the machinery division of Dravo Corp.—considers here industrial buildings of corrugated sheet iron construction, suggesting various means for reducing the initial and operating costs of the heating installation, and giving an example of a direct fired air heating system, using duct distribution, with the heaters fired by stokers.

There are many methods and variations of methods for heating large plants and buildings. The heating engineer must know them all, if the right one for a particular installation is to be selected.

The air is picked off the floor b the fans, discharged through th heaters, and then on to the duc system. After reaching the floo the air has to travel all the wa back to the heaters. This two di rectional movement promotes goo distribution of heat over the floo and helps to assure warm air reach ing the floor.

The waste gases are handled b an induced draft fan mounted o the shaft of the main fan. N high stacks, as required for natur draft, are necessary. Automati temperature control actuating th stokers maintains the building tem perature within close limits.

This method of heating has cha acteristics that lend themselves p culiarly to a heating problem

Indoor-Outdoor Temp. Differential	No. of Air Changes per Hr	Temp. Diff. Floor to Ceiling	Roof	Approximate Heat Loss Btu/
40	½	10	Insulated	9,680,000
40	½	10	Non-insulated	11,560,000
40	1	10	Non-insulated	13,000,000
50	1	15	Non-insulated	16,500,000
60	1	15	Non-insulated	19,100,000

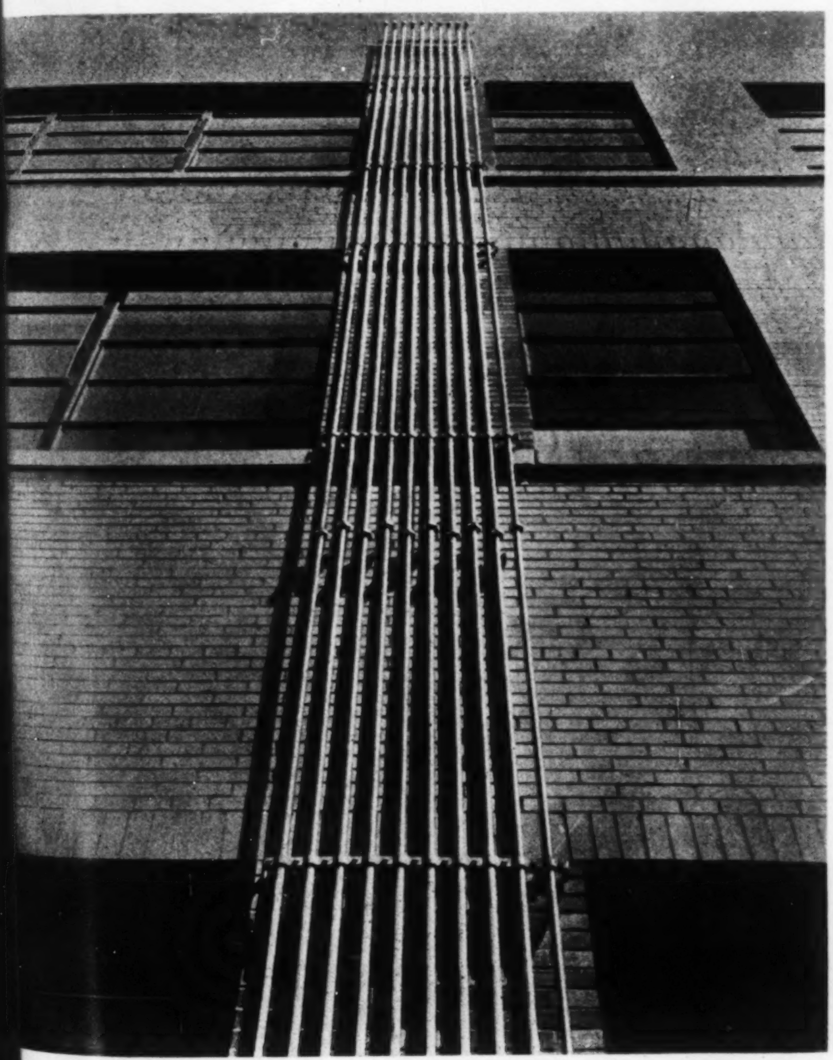
this kind; in other words, they help to justify the heating of such a building. Among them might be mentioned that there is nothing in this heating system to freeze up. This means that lower temperature differentials can be carried and if the plant is shut down on week ends, the system can be shut down if no plant heating is necessary. The simplicity of the system means less upkeep, less attention, and less skilled personnel. No licensed operators are required, the duties of the operating personnel consisting of cleaning fires and removing ashes, assuming there is provided coal handling equipment for keeping the stokers supplied with coal.

During the winter, outdoor air can be mixed with the recirculated air. In the summer the system can bring in and distribute 100 per cent outdoor air. Under such conditions the fans would discharge directly into the duct system using a bypass around the heater.

Stainless Steel Pipe, Valves, and Fittings Resist Corrosion of Hormone Process

Dog sledges have penetrated far across the frozen Siberian plains, and side-wheeled steamers way up the Amazon, to bring back to market vital oils and herbs for the corner drugstore. Today, however, the laboratories of leading drug manufacturing establishments are creating valuable remedies from chemical raw materials that are abundant, so to speak, in "our own backyard." The Ciba Pharmaceutical Co., at a plant in New Jersey, for instance, produces hormones—which play an important part in medical treatment for glandular deficiencies.

Through this bundle of stainless steel pipes pass vapors of organic solvents, used for processing operations in the manufacture of hormones



Much of the processing equipment at the plant is of stainless steel. An interesting application of the metal that has attracted many passersby is a bundle of vent pipes, which extend up the exterior wall of one of the processing buildings. These pipes connect with underground tanks that store organic solvents. Satisfactory service is obtained with stainless steel tubing because the metal is resistant to the corrosive attack of the chemicals and its exterior surfaces show no ill effects of continued exposure to the atmosphere.

Large numbers of stainless steel valves are used in the extensive installations at this plant for synthesizing hormones. The valves on reaction kettles have withstood the action of corrosive agents, such as acetic acid, for a number of years, and they have given extremely reliable service.

* * *

Every community should adopt a "work pile plan" now as an essential part of postwar planning. Practically every business firm—from the smallest retail store to the largest factory—knows of certain expenditures for repairs, modernization, expansion, or conversion which it will probably make after the war.

Cold Bending of Pipe for Fighting Ships

Joe Klein, Pipe Shop Foreman at Chicago Bridge & Iron Co.'s Seneca Shipyard, Briefly Describes Methods Used for Over 700 Cold Bends per Ship

PIPE BENDS have a wide range of usefulness in marine work, especially to solve the many problems of space requirements, which are ever present in shipbuilding. They are used to provide flexibility in the system, to minimize friction losses, to avoid obstructions, to compensate for expansion and contraction, and to eliminate fittings where possible, thereby cutting down the opportunity for leaks and lowering installation costs on labor and material.

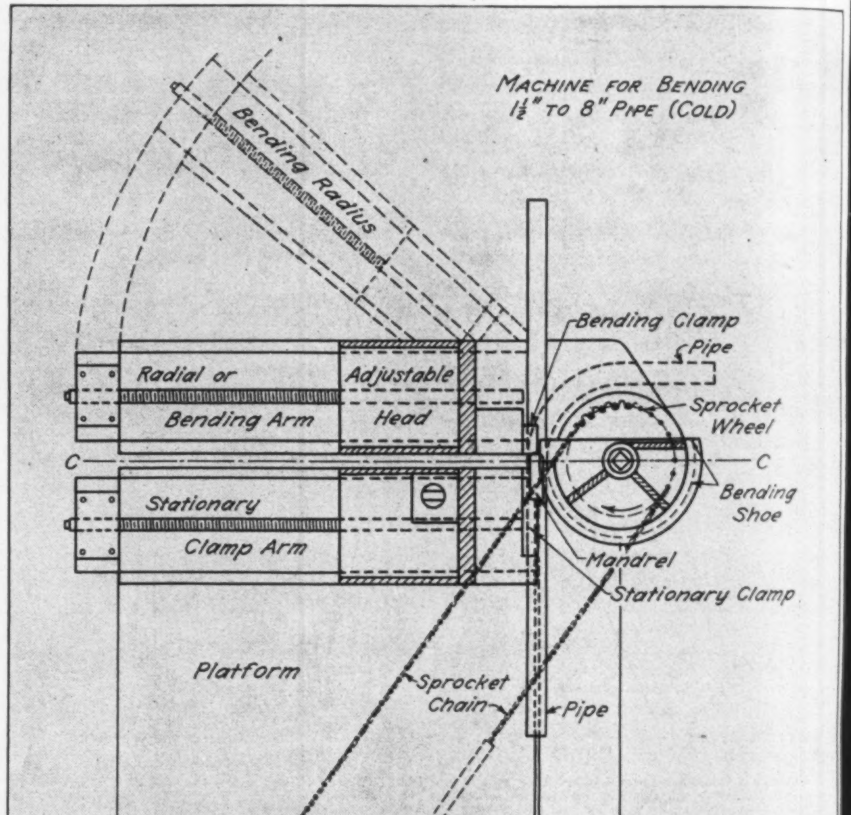
700 Cold Bends per Ship

There are two general processes of bending pipe—hot bending and cold bending. We use both, but prefer cold bending where possible as it eliminates such time consuming procedures as packing with sand, capping, heating, applying water, and cooling. Also, in the use of the cold bending process, a man may stand directly over his work and he can detect any flaws in the pipe that might appear, which is not possible in hot bending. Likewise, in cold bending, pipe may be handled immediately without going through the cooling process. Furthermore, templates may be placed on the pipe during the process of cold bending, thereby obtaining a greater degree of accuracy. For these reasons, we are doing as much cold bending of pipe as possible. Of a total of approximately 900 bends on each ship, 700 are cold bends.

We use three types of equipment for the cold bending of pipe. The first is a hand operated bender for pipe from 1 in. to 4 in. in diameter; it is very compact and is used exclusively on the ships where space is very often confined to narrow limits. It is used to handle pipe in place to obtain proper fits.

The second bender we use is a hand operated hydraulic machine which can handle pipe from 1¼ in. to 4 in.

These two benders work on the same principle of clasping the pipe at two points and applying pressure on the middle of the pipe. In


MACHINE FOR BENDING 1½" TO 8" PIPE (COLD)
Bending Radius
Bending Clamp
Pipe
Radial or Bending Arm
Adjustable Head
Sprocket Wheel
C
C
Bending Shoe
Stationary Clamp Arm
Mandrel
Stationary Clamp
Platform
Sprocket Chain
Pipe
Pneumatic Cylinders
Mandrel Rod
Pneumatic Cylinder

order to obtain smooth bends, it is necessary to apply this pressure many times from 1 to 2 in. apart.

One Operation

The third bender we employ is able to make the bend in one complete operation. The accompanying illustration shows its principal working parts. The bending clamp arm holds the pipe to the bending wheel and the wheel and the bending clamp arm move together clockwise, bending the pipe. The stationary clamp holds the pipe in place. The mandrel fits snugly inside the pipe and its proper adjustment is vital to obtain a smooth bend. The end of the mandrel must be exactly at the bending point. If it is too far forward, it will cause the pipe to be ridged on the outside. If it is not far enough forward, it will cause the pipe to flatten. Straight ends on the pipe are required of a length equal to the diameter of the pipe plus 1 in. This is necessary so that the bending clamp arm may be fastened to the pipe. If two bends are required, the straight length of the pipe between them must be equal to the pipe diameter plus 1 in.

We still do considerable hot bending because shorter bends can be made with this process than with the available cold bending devices. With the speeded up production of the present day, however, cold bending has enabled us to save many man hours of labor and has aided materially in increasing production.

Welding Society Hears Reports on Piping and Tubing

MEMBERS OF the American Welding Society met at the Morrison Hotel, Chicago, last month to hear a number of reports on welding piping and tubing, testing welds and pressure vessels, inspection of pressure vessels, and other subjects.

In their paper on The Effect of Normalizing on the Properties of Welds in Carbon-Molybdenum Steel Pipe, I. A. Rohrig, D. H. Corey, and Sabin Crocker, all of The Detroit Edison Co., presented the results of a laboratory investigation undertaken with a view to determining the effect of normalizing arc welded joints in such pipe instead of stress relieving them at 150 to 1250 F as has been general practice heretofore. Normalizing serves to relieve residual stresses and at the same time produces desirable structural changes in the metal that cannot be effected below the critical temperatures, they said.

The authors' company uses carbon-molybdenum steel pipe for high pressure, high temperature lines designed to carry steam at 865 psi and 910 F. From the standpoint of good creep resistance, carbon-molybdenum steel pipe made according to the melting practice of ASTM designation A206 is believed to be most satisfactory for high temperature service when the grain size is 3 to 6 and a predominant Widmanstätten type of structure exists in either the hot rolled or the normalized condition. The structure of the deposited weld metal and that of the adjacent pipe metal that is affected by the heat of welding are quite different from the structure of the hot rolled or normalized pipe metal. Normalizing was undertaken to produce the desired grain size and structure in the weld metal and in the heat affected area.

Notch toughness tests and tensile tests were made of a carbon-molybdenum pipe-to-pipe weld and tensile tests were made of carbon-molybdenum all-weld metal. Tests were made of the pipe-to-pipe weld after stress relieving at 1200 F and after normalizing at 1725 F. The all-weld metal was tested as-welded, after stress relieving at 1200 F, and after being normalized for 1 hr at 1550, 1650, and 1725 F. Charpy V-notch and keyhole notch toughness specimens and 0.500 in. diameter and 0.250 in. diameter tensile specimens were used. The welds were made with class E-6010 electrodes of both $\frac{1}{8}$ in. and 5/32 in. diameter.

Normalizing carbon-molybdenum weld metal at temperatures of 1550, 1650, and 1725 F for 1 hr has no significant effect upon its tensile strength, which in the present tests remained above 60,000 psi in all cases, according to the paper. The notch toughness of carbon-molybdenum weld metal and of hot rolled pipe metal is improved through normalizing at 1725 F, but the notch toughness of the heat affected area is good in the as-welded condition and is not greatly affected by normalizing. Traces of columnar structure that are often present between beads are refined by normalizing so that greater homogeneity is obtained throughout the deposited metal. At 1725 F, the weld metal contained several very evident Widmanstätten areas but it resisted grain coarsening up to approximately 1800 F.

The lowest practicable temperature for normalizing carbon-molybdenum welds is approximately 1550 F but at this temperature the pipe metal takes on a fine grained structure. At 1725 F, the desired type of structure usually can be obtained in the pipe metal and the structure of the weld deposit is improved, the authors stated.

In a paper on gas weld and furnace weld tubing for construction purposes, A. C. Weber of Laclede Steel Co. stated that recent developments in the manufacture of fusion weld tubing by the gas process have resulted in wide application for pipe and light wall tube in many construction fields.

By far the outstanding application of welded tubing in construction work has been its use in the artificial cooling systems for large concrete masses such as Boulder, Grand Coulee, and Shasta dams, according to this paper. In these structures the rate of construction speed and tremendous mass of concrete require that some method of artificial cooling be employed to carry off the heat developed during the hydration of the cement. Concrete temperatures as high as 140 F, which could prove detrimental in the development of cracks and irregular distribution of stress through the structure, can be reduced rapidly through the circulation of cooling water through the concrete during construction.

Thousands of miles of 1 in. welded tubing have been employed in these concrete dam circulating systems. The intricate network of cooling pipe is carried throughout the entire dam section.

Air Conditioning and Heating Laboratory Supplements Classroom Instruction

J. H. Carpenter, Assistant Professor of Mechanical Engineering at Syracuse University, Describes Installation Which Illustrates Functions of Many Types of Air Conditioning, Heating and Ventilating Equipment

Courses in the theory of heating and ventilating have been offered by the college of applied science at Syracuse University for the past 40 years. It was not, however, until comparatively recently that laboratory equipment was made available to supplement the lecture and problem course. Laboratory tests illustrate the functions of many types of heating, ventilating, and air conditioning equipment under varying conditions and with different arrangements.

The basic principles of comfort conditioning, industrial cooling and air conditioning, and product refrigeration are identical. Practice has established the temperatures and humidities required for many different types of application. With proper usage such a laboratory serves in demonstrating the principles and natural laws that pertain throughout the entire field of thermal engineering.

The construction of a suitable air conditioning, heating, and ventilating laboratory involves a substantial sum of money. This is evident when you consider equipment, ductwork, and supplementary services such as plumbing, wiring, steamfitting, refrigerant piping, control piping, and labor. Labor of installation was performed by the mechanics of the university shops. Working drawings of the entire project were made before construction was started, in order that space requirements and the most convenient arrangement of equipment, including piping, valves, and the like, could be determined. Fig. 1, showing the builtup air conditioner, reveals the planning required in order that the various elements of the system might be installed without conflicting with one another.

It was considered desirable to select equipment that would cover the broad field of heating, ventilating, and air conditioning as completely as several factors would permit. Available space dictated compactness. The laboratory is used by both undergraduates and graduate students and therefore it had to be adaptable to the requirements of each.

Use of Steam

Study of the steam requirements of the various elements of the selected heating apparatus indicated that low pressure steam (0 to 15 psi) was necessary. Steam is supplied to the college from the university steam station at 110 to 120 psi gage and 1 to 3 F superhe
The steam is piped from the poi
of entrance into the building to t
laboratory at full line pressure. T
pressure is reduced in the labor
tory by a pilot type pressure
ducing valve to a range of 15 to
psi gage, depending upon valve s
ting. A safety valve, set at 15 p
is installed on the low pressure si
of the valve. Normally the red
ing valve is set at 12 psi gage a
further pressure reduction is ma
manually by use of needle val
installed in branch steam lines n
inlets of the air heaters and clos
water heater. Tests on radiat
and blast heaters are normally
at 1 to 5 psi gage.

A high pressure steam bra
line is taken off the bottom of
high pressure supply and extend
to within approximately 4 ft of
floor and is dripped with a hi

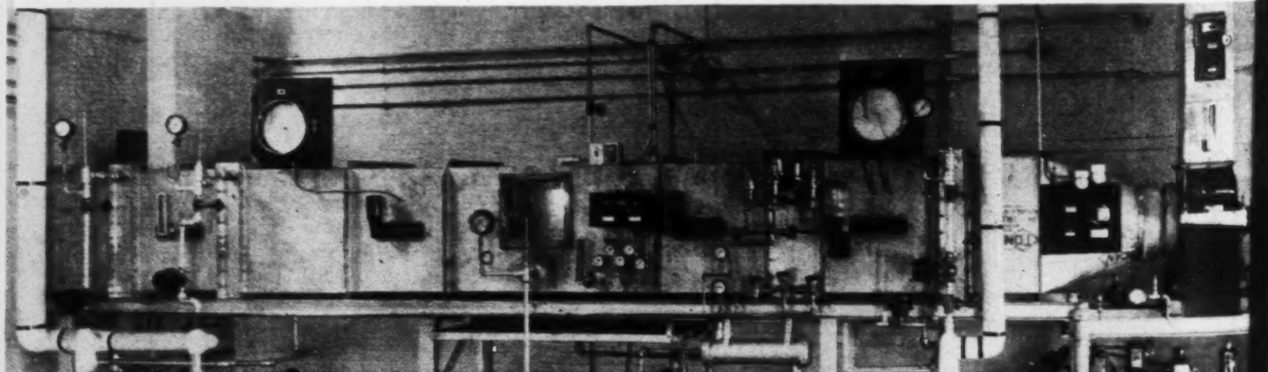
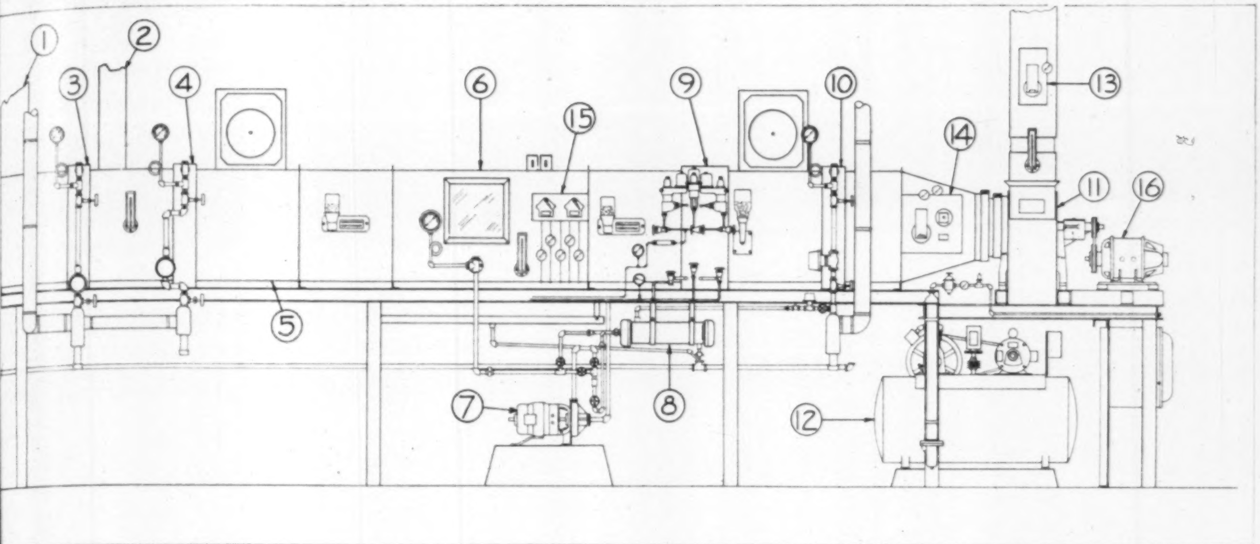


Fig. 1—The builtup air condition
unit



g. 2—The builtup air conditioning it showing: (1) Outside air intake.) Return air duct. (3) Tempering il. (4) Preheater coil. (5) Filter tion. (6) Air washer. (7) Air sher pump. (8) Closed water heat- . (9) Cooling coil. (10) Reheater il. (11) Fan. (12) Air compressor. 3) Final temperature thermostat. 4) Dew point thermostat. (15) Man- l selective control switches. (16) Motor (fan)

essure trap. This line serves two rposes—to provide high pressure eam at a convenient location for e occasional testing of high pres- re devices such as traps; and to rve as a condensate drip just ead of the pressure reducing lve.

All steam supply piping is in- lated with 85 per cent magnesia vering and all fittings and valves clusive of unions are covered with bestos cement. The length of eam piping and the efficiency of e insulation are such that 2 to 3 F the superheat developed as a sult of the pressure reduction at e reducing valve is available in e steam at the points of entry o the steam operated devices. is condition eliminates the neces- y of installing calorimeters for termining steam quality. Ther- ometer wells and mercury ma- meter tube connections are pro- ed at the inlet of each item of ipment supplied with steam, in er that the degree of superheat operating pressure may be de- mined.

t is interesting to note that in series of preliminary tests con- cted in the general mechanical oratory it was indicated that en steam contained not more than 1 to 2 F superheat it was difficult to detect its presence on a laboratory grade thermometer used in conjunction with an oil filled brass thermometer well. However, when a bare thermometer bulb was exposed to a steam sample of reasonably constant pressure more reliable readings were obtained. Replacing the wells with stuffing boxes permits exposing the thermometer bulbs directly to the steam, packing similar to that used on gage glasses being employed.

Motors and Electrical Requirements

In laboratory work it is especially desirable to operate certain motor driven devices at variable speed. This was easily accomplished in the case of this air conditioning laboratory by utilization of an existing direct current service. The builtup conditioner fan and condensing unit are driven by 115 volt d-c motors. Each motor is equipped with a disconnect switch and a combination starter and speed controller with overload and low voltage protection. Starting fuses are enclosed in the main laboratory d-c panel.

All other motors in the laboratory are operated on 220 volt or 110 volt, single phase, 60 cycle current. A 220 volt, 60 cycle, three phase, three wire supply was available when the space was taken over for the laboratory. A 2 kva transformer was installed on one phase of the three phase supply to obtain 110 volt, single phase current. Two hundred twenty volt, single phase current is taken from the two remaining phases. This arrangement permitted great flexibility in the selection of motors and equipment and saved the expense of extending a single phase, 220-110 volt, three wire supply from a remote panel. Each a-c motor is equipped with a thermal overload type disconnect switch located near the motor. A partitioned panel is installed to enclose the branch circuit fuses for the various motors. Two fuse blocks are provided for future 220 volt, three phase circuits. A main disconnect switch is installed on the three phase supply ahead of all new equipment. Some unbalance of phases results from the layout described above, but this is not important when consideration is given to the large connected load of the university.

Air Conditioning Apparatus

The largest and most useful apparatus installed is the builtup air conditioner, Fig. 2. This unit is built up from several items of equipment, each having proper capacity to perform specific functions. The unit is complete with outside air intake and return air connection, filters, tempering and preheater coils, air washer, direct expansion "Freon 12" cooling coil, reheater, and fan. It has a much greater length than a commercial unit of equal capacity because space has been provided between the various elements to permit measurement of velocity and temperature of the air.

A flange type joint, secured by bolts, was employed to facilitate the removal of any part of the system, such as cooling or heating coils, for repairs or replacement. Space was provided in the main body of the unit for the installation of many types of filters. Provision has been made for the collection of condensate from all heating coils. The unit fan may be operated to discharge air through a spun aluminum calibrated nozzle for determining total air quantity handled, or by means of a selective damper the air may be conveyed to the classroom above the laboratory where methods of air distribution can be demonstrated and tested.

Since the normal college year extends from September to June it was considered advisable to arrange the equipment in the builtup conditioner in a manner that would permit the simulation of summer conditions during this period regardless of existing outdoor conditions, permitting tests to be run on the cooling coil and air washer (evaporative cooling). By means of the tempering and preheater coils and a compressed air operated water atomizing nozzle it is possible to secure wide ranges in temperature and humidity on the inlet side of the cooling coil and air washer.

Inasmuch as the air quantity handled by the builtup unit is small (700 cfm) and the space limited, no standard commercial air washer was available. A small two bank air washer was designed to meet the particular requirements and this was constructed in the university shop. It is equipped with 12 spray nozzles per bank, which when operating at 10 psi pressure have a spray water capacity of 7.0 gpm. This equals 10 gpm per 1000 cfm. No flooding nozzles are used. The eliminator plates are spaced $1\frac{1}{8}$ in. on centers. Each plate is formed from a single sheet of metal and has four bends or changes of air direction. The washer is provided with a water float valve for maintaining the proper water level in the tank. An overflow pipe and large surface water strainer are also provided. Spray water is circulated by a single stage, close coupled pump mounted on a suitable foundation below the washer. While this washer does not have the efficiency of many commercial air washers it has proved to be effective in demonstrating evaporative cooling and humidification.

The cooling coil is of the extended fin type, three rows deep in the direction of air flow, with row control (expansion valve for each row). With a variable speed condensing unit and a cooling coil that may be operated with one-third, two-thirds, or all of its surface active it is possible to demonstrate many of the situations encountered in the field. For example, it is possible to show the effect on th leaving wet and dry bulb temperatures when the coil is operated a constant refrigerant temperatur and air quantity, but the amount o coil surface is varied. Shutoff valve are installed on the liquid and suction sides of each row of the coi An air bypass is provided over th top of the coil. This, combined wit the reheater, affords an opportunit to demonstrate both means of reheat for partial load temperatur and humidity control.

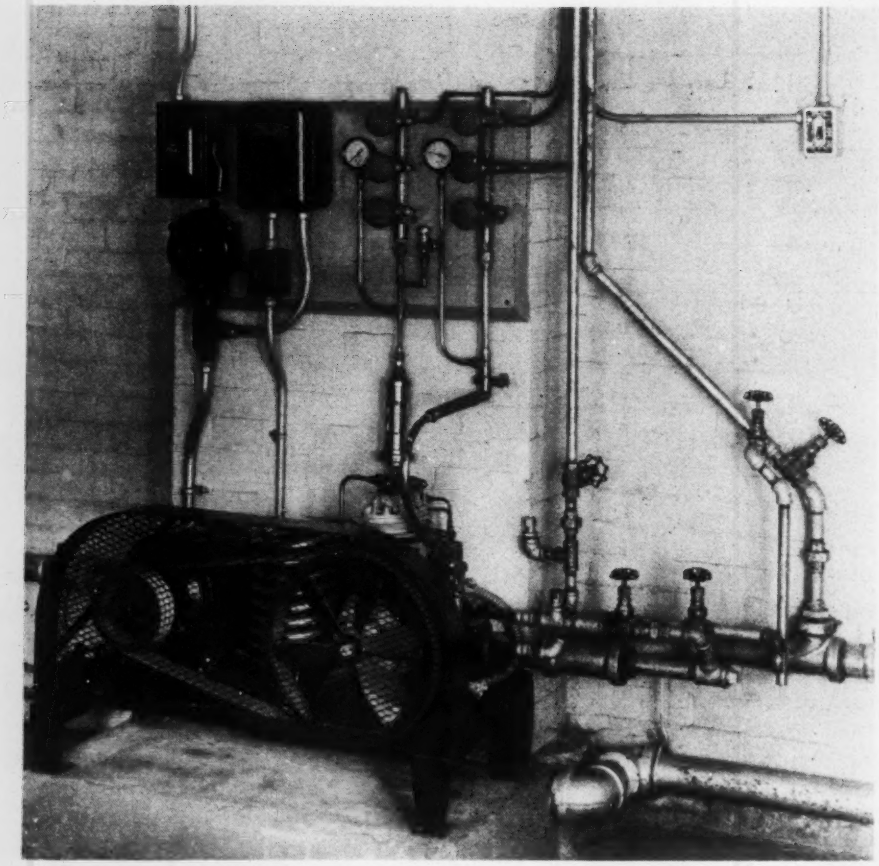


Fig. 3—The condensing unit installation, showing the suction and liqui manifolds on panel

Automatic Control

To illustrate the common methods of controlling blast heater face and bypass dampers, air washer dewpoint by use of either blas heaters or closed water heater, an modulating expansion valves, pneumatically actuated system automatic control was installed. B means of manual selective valves is possible to change readily fro the heating cycle to the coolin cycle. The source of air for th controls and the water atomizin nozzle is a high pressure air compressor (operates as high as 80 p pressure) which discharges into storage tank. Compressed air fo the controls is reduced to 15 p gage; the supply to the atomizin nozzle is reduced to approximatel 30 psi pressure. An electro-pneumatic switch installed in the fa motor circuit permits air to be supplied to the control instrumen only when the fan motor circuit energized.

A multi-louver damper, operate by a static pressure regulator, installed in the builtup unit ju ahead of the preheater coil. Stat pressure control will be a defini aid in demonstrating air flow wi several types and makes of outlet

An access door is provided ne the fan inlet in order that an eucalyptus leaf smoke pot might effectively used. The air throw and distribution from various types of outlets may be determined quite easily by the smoke test method.

Self-Contained Units

In addition to the builtup air conditioner, there are two types of year 'round unitary equipment installed in the laboratory. One of these is a self-contained room air conditioner, complete with condensing unit, cooling and heating coils, humidifier, circulating fan and filters, all enclosed in a soundproofed factory finished cabinet. The other unit, complete except for condensing unit, is installed in the classroom above the laboratory and operates from the condensing unit which supplies cooling for the builtup apparatus. Manifolds installed on the suction and liquid sides of the condensing unit permit operation of either apparatus from the same refrigeration machine. (Fig. 3.)

Both units are provided with thermometer wells, gages, weighing tanks, and the like in order that test data may be collected. The self-contained unit in the laboratory is equipped with a discharge nozzle replacing the usual air discharge grille. This allows more accurate determination of the air quantity handled. The nozzle discharge velocity is high enough to permit the use of an impact tube and inclined draft gage to ascertain the average discharge velocity. Again provision has been made to collect condenser cooling water and heater condensate in weighing barrels or, if this is not desired, either or both may be wasted to the sewer.

Direct Gas Fired Conditioner

The laboratory also contains a direct type gas fired conditioner, complete with circulating fan, filters, humidifier, and supply and return ductwork. There is a gas meter near the unit in order that the gas consumption may be determined. Connections in the furnace breeching ahead of the draft diverter permit the determination of flue gas temperature and flue gas analysis by Orsat apparatus. Several thermometers are used in both the supply and return ductwork near the unit to allow determination of the average inlet and discharge temperatures. The discharge air quantity is determined by an impact tube and calibrated nozzle installed at the end of the supply duct. The circulating fan is provided with a variable speed sheave to allow the unit to operate at various air quantities. A bullseye and internal casing light permit use of a strobotachometer for determination of exact fan speed. This method was adopted to reduce the possibility of casing leakage to a minimum and also maintain it as constant as possible during a test run.

Direct Radiator

A 60 sq ft tubular type cast iron radiator is installed on a pedestal to afford an opportunity to perform rating tests. These tests are conducted in accordance with the American Society of Heating and Ventilating Engineer's code for testing radiators, and are performed at pressures ranging from 1 to 5 psi gage.

The discharge of the radiator is equipped with a bronze casting containing a 3 in. bullseye and tappings for a thermometer well and recording thermometer bulb. Both temperature tappings are located in such manner that the thermometer bulbs are above the normal water level in the casting and indicate the steam temperature ahead of the trap. Any tendency of the radiator trap to hold back condensate is immediately visible on the bullseye.

Tests

Equipment installed in the laboratory is sufficiently diversified to permit performance of a relatively large number of tests, such as:

1) Rating test of a direct cast iron radiator.

2) Rating test of an extended fin copper blast coil.

3) Performance and efficiency test of a reciprocating condensing unit.

4) Performance test of an extended surface direct expansion cooling coil.

5) Approximate friction loss in various types of ductwork fittings and connections.

6) Efficiency test of a direct type gas fired air conditioner.

7) Study of fan characteristics (backwardly curved blades).

8) Common methods of controlling heating, cooling, dehumidifying, and humidifying equipment.

9) Air washer performance and characteristics.

10) Study of many types of air filters and their relative efficiencies.

11) Overall performance test and heat balance analysis of a central type air conditioning unit.

12) Overall performance test and heat balance analysis of a self-contained type air conditioner.

In addition to the actual performance of experiments a considerable amount of time is spent in the laboratory pointing out the construction details of such things as steam piping, water and refrigerant piping, and control systems. This method has proved to be more effective than lecture and blackboard sketching in the classroom. The students like to get their hands on things and examine them at close range.

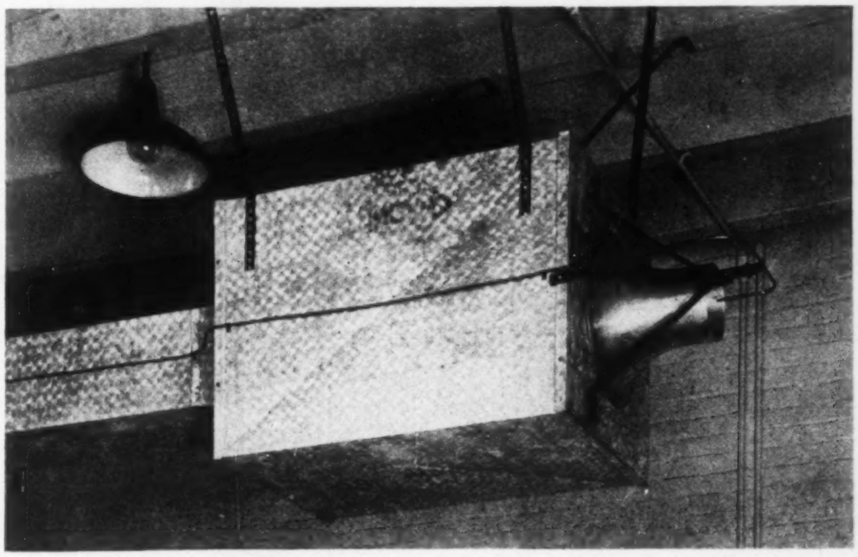


Fig. 4—Calibrated spun aluminum nozzle for determining air quantities

MEASURING the FLOW of FLUIDS

William Goodman Gives Practical Data on the Use of Orifices and Manometers

INTRODUCTION OF an orifice into a piping system causes an additional loss in pressure. In some piping systems, the additional loss may be negligible while in others it may be important.

Pressure Loss Due to Orifice

The permanent pressure loss due to the orifice is less than the pressure difference across the orifice. The percentage of the pressure difference across the orifice which is actually lost permanently can be found by means of Table 5.*

The following example illustrates the method of determining the permanent pressure loss due to the orifice.

Example 7: Take the conditions of example 3, p. 462, September HPAC, and find at the maximum flow the permanent pressure loss due to the orifice.

Solution: According to example 3, pressure difference is 6.7 psi and orifice selected is a 2½ in. orifice in a 4 in. pipe. Referring to Table 5 for a 2½ in. orifice in a 4 in. pipe, the permanent pressure loss is 59 per cent of the pressure difference across the orifice. Hence, the permanent pressure loss = 0.59 x 6.7 = 4 psi.

Where the pressure loss due to the orifice is important, the length of the manometer mercury column for the maximum flow and, hence, the minimum size of the orifice, will be limited by the allowable pressure loss. Although small orifices and long manometers make for accurate measurement of the flow, they also introduce large pressure losses which may be undesirable in many piping systems. On the other hand, short manometers with large orifices introduce a large percentage of error and, where variable flows must be measured, they limit the minimum flow that can be measured accurately.

New Methods

Situations frequently arise in industrial and engineering work where a knowledge of the quantity of fluid flowing through a pipe line is essential or desirable. In field tests an orifice permanently installed can be used to obtain much valuable information about the performance of equipment. Furthermore, orifices and manometers are invaluable for measuring flow rates in laboratory test work. Orifices and manometers are relatively simple to select and use. Given the proper data, an accurate orifice can be selected for measuring the flow of almost any fluid.

If care is used in the installation and operation of these instruments, they will give highly accurate results. Although orifices and manometers are not difficult to use, the data needed for selecting the flow coefficient for any fluid has not been available in convenient form.

The accuracy of flow measurement depends entirely upon how accurate the flow coefficient *K* of the orifice is known. This flow coefficient *K* is used in computing the quantity of fluid flowing through the orifice. Heretofore when computing the flow through a given orifice for any measured pressure difference, trial and error methods have been necessary in determining the correct flow coefficient *K*. With the methods presented in the article of which this is the fourth part, the flow coefficient *K* can be found directly once the pressure drop across the orifice has been measured by means of a manometer. Furthermore, in this article all of the practical data needed to select and use orifices and manometers are given.

Mr. Goodman is consulting engineer, the Trane Co., and a member of HPAC's board of consulting & contributing editors.

Measuring Minimum Flow

A discussion of the small errors due to uncertainties in the exact value of the flow coefficient *K*, and of the uncertainties in the values of density and viscosity of the fluid, is beyond the scope of this paper. Furthermore, these errors are beyond the control of the user of orifices and manometers. On the other hand, one of the largest sources of error is within his control. It has been the author's experience that the greatest error in measuring the flow is due to inaccuracies in determining the height of the mercury column. Consequently, the discussion in this section is confined to the method of minimizing this error.

The height of a mercury column changes quite rapidly with a change in flow. Thus, if the manometer indicates 16 in. of mercury for the maximum flow, it will indicate 4 in. if the flow is reduced 50 per cent. The reason for this is, of course, that the height of the mercury column changes with the square of the flow. If the manometer can be read accurately to, say, within only ¼ in., the percentage of error will be very much larger if the rise of the mercury column is 4 in. than if it is 40 in. In other words, the percentage of error in reading the manometer for a flow that has been reduced to 50 per cent of maximum is very much greater than the percentage of error at full flow.

One of the factors that contributes to the inaccuracy of manometer readings is pressure pulsation in the pipe line. Pressure pulsation is almost impossible to avoid and, as a result, the mercury in the manometer will fluctuate continually around a mean position. In

---

*According to paragraph 56 on page 17 of the ASME publication, Flow Measurement—1940, the permanent pressure loss may be computed approximately from the following formula:

$$\frac{p_L}{p} = \frac{1 - K\left(\frac{D}{D_1}\right)}{1 + K\left(\frac{D}{D_1}\right)}$$

As mentioned in a previous footnote average values of K corresponding to different values of the ratio (D/D_1) were determined. Substituting these corresponding values of K and (D/D_1) in the equation above, it was possible to determine different values of the ratio (p_L/p) corresponding to values of the ratio (D/D_1). A curve was then plotted of (p_L/p) versus (D/D_1). Values of (p_L/p) read from this curve were used in preparing Table 5. Although the values in Table 5 are approximate, they are sufficiently accurate for estimating the permanent pressure loss through an orifice.

Copyright 1943 by William Goodman

an effort to eliminate the pulsation of the mercury column, needle valves are used in the tube connections to the manometer. These valves when just cracked open will usually dampen out the pressure pulsations in the pipe line so that the mercury column is fairly level and pulsates only slightly. However, even though the mercury column is practically stationary, there is no assurance that the mean position it assumes is actually equivalent to the pressure difference across the orifice. Hence, it is doubtful if mercury columns can be read with a high degree of accuracy. However, at full flow with a rather large rise of the mercury column, the error in the measured flow is very small. One of the factors that makes the error small is that the error in the flow computed by means of equation 1 [on p. 413, August HPAC] is not the same as the error in reading the mercury column. The percentage error in the computed flow is only one-half of the percentage error in reading the mercury column. Thus, if the error in reading the mercury column is, say 4 per cent, the error in the computed flow will be only 2 per cent. This fortunate characteristic means that the flow can be computed quite accurately even though the mercury column cannot be read quite so accurately.

For instance, for the conditions of example 4 [p. 462, September HPAC], by using equation 8a [p. 526, October HPAC] it is found that the mercury column would rise 15 in. Suppose that the height of the mercury column can be read accurately only to within ¼ in. In 15 in., the error would be (0.25/15) x 100, or 1.7 per cent. The error in the computed flow would consequently be 0.85 per cent or about 2.5 gpm for a maximum flow of 294 gpm. On the other hand, if at times the flow of brine were reduced to 147 gpm, the height of the mercury column would be reduced to about 3¾ in. An error of ¼ in. in reading the mercury column at this low flow would amount to (0.25/3.75) x 100, or 6.7 per cent. Accordingly, the error in the measured flow would be one-half of 6.7 per cent, or about 3.4 per cent. For a flow of 147 gpm, the error in the measured flow would be about 5 gpm.

SYMBOLS

D = throat diameter of orifice in plate, in.;
D_1 = inside diameter of pipe in which orifice is installed, in.;
E_F = percentage error in measurement of weight flowing at minimum flow;
E_M = percentage error in reading manometer scale at minimum flow;
h = height of mercury column in manometer, in.;
h_M = height of mercury column in manometer at minimum flow, in.;
K = flow coefficient of orifice;
p = pressure difference across orifice, psi;
p_L = permanent pressure loss of fluid due to orifice, psi;
W = weight of fluid flowing through orifice, lb per min;
W_M = minimum flow to be measured by orifice, lb per min.

Table 5—Permanent pressure loss across orifice in per cent of pressure difference

Orifice Diameter Inches D	Nominal Pipe Size — Inches								
	2	2-1/2	3	4	5	6	8	10	12
5/8	90%								
3/4	85	90%							
7/8	80	86							
1	74%	82%	88%						
1-1/8	68	77	85						
1-1/4	61	72	82	89%					
1-3/8	54	67	78	87					
1-1/2		62%	74%	84%	90%				
1-5/8		54	70	82	88				
1-3/4		48	65	79	86				
1-7/8			60	76	84				
2			55%	73%	82%	88%			
2-1/8			50	70	80	86			
2-1/4				67	78	84			
2-3/8				63	76	83			
2-1/2				59%	73%	81%	89%		
2-5/8				55	71	79	88		
2-3/4				51	68	78	87		
2-7/8					65	76	86		
3					62%	73%	84%	90%	
3-1/4					56	69	82	88	
3-1/2					50	64	79	87	
3-3/4						60	76	85	89%
4						54%	73%	83%	88%
4-1/4						49	70	81	86
4-1/2							67	78	84
4-3/4							63	76	83
5							59%	74%	81%
5-1/2							52	68	77
6								63	73
6-1/2								57	69
7								52%	64%
7-1/2									59
8									54
8-1/2									48

Where variable quantities of fluid must be measured by means of the orifice, the minimum length of the manometer is governed by the accuracy with which the largest flow is to be measured. Table 6† shows the length of the manometer required to measure the maximum flow for any given error in measuring the minimum flow. Thus if the minimum flow is 40 per cent of the maximum flow, and the mini-

---

†Assuming K constant, the relation between the minimum and maximum flow and the height of the mercury column may from equation 1 of the text [p. 413, August HPAC] be written:

$$\frac{W_M}{W} = \sqrt{\frac{h_M}{h}} \quad \text{............[a]}$$

$$\frac{h_M}{h} = \left(\frac{W_M}{W} \right)^2 \quad \text{........ [b]}$$

The per cent error in reading the manometer at minimum flow is

$$E_M = 100\,\frac{\triangle h}{h_M} \quad \text{............[c]}$$

where $\triangle h$ = smallest distance to

Table 6—Height of mercury column required for maximum flow if error at minimum flow is not to exceed percentages shown (see text)

Percent of Maximum Flow	Percent Error in Measuring Minimum Quantity Flowing Through Orifice		
	1%	2%	5%
10%	1250 in.	625 in.	250 in.
20	312.5	156.2	62.5
30	138.9	69.4	27.8
40	78.1	39.1	15.6
50	50.0	25.0	10.0
60	34.7	17.4	6.9
70	25.5	12.8	5.1
80	19.5	9.8	3.9
90	15.4	7.7	3.1

mum flow is to be measured with an error not to exceed 2 per cent, Table 6 shows that a mercury column 39.1 in. long is required to measure the maximum flow. With a mercury column 39.1 in. long at maximum flow, the mercury column at a flow of 40 per cent of maximum will be high enough so that the error in reading it will not exceed 4 per cent, and consequently the error in the measured flow will not exceed 2 per cent. For flows greater than 40 per cent of maximum, the percentage error will, of course, be less than 2 per cent.

If the minimum flow of 40 per cent of the maximum flow need not be measured with an accuracy greater than 5 per cent, Table 6 shows that the height of the mercury column at the maximum flow need only be 15.6 in. For all flow rates greater than 40 per cent of the maximum, the error will, of course, be less than 5 per cent.

Table 6 is based on the assumption that the height of the mercury column in the manometer cannot be read with an accuracy greater than ¼ in. Admittedly, this is purely empirical, but it represents a reasonably safe value. Even if the taps to the manometer have been throttled so that mercury is almost standing still, there is, as has previously been stated, always the question whether the manometer is indicating the true pressure difference, and it is quite possible that the error may be as much as ¼ in. At least, those who use the values in Table 6 for selecting the maximum length of manometer can be reasonably sure that the manometers are long enough to give reasonably accurate measurements down to the minimum flow.

If very low flow rates must be measured accurately, it is apparent from Table 6 that excessively long manometers will be required for reading the maximum flow. To avoid the use of long manometers, it is common practice to use a second small orifice and a bypass around the larger orifice to read the smaller quantities. In this manner, by using two orifices, a large one and a small one, reasonably short manometers can be used to measure accurately both the large and small quantities of liquid flowing.

For the conditions of example 4, equation 8a shows that the rise in the mercury column at the maximum flow of 294 gpm would be 15 in. With a rise of 15 in., example 7 shows that the permanent pressure loss would be 4 psi at the maximum flow. However, with a 15 in. rise at the maximum flow, it is apparent from Table 6 that the minimum flow that could be measured with an error not to exceed 2 per cent would be somewhere between 60 and 70 per cent —say, 65 per cent—of the maximum flow. For an error not to exceed 5 per cent, Table 6 shows that the minimum flow should not go lower than approximately 40 per cent. If the height of the mercury column is limited to 15 in. and if the error in the measured flow may not exceed 5 per cent, a second orifice installed in a bypass will be necessary if a flow smaller than 40 per cent of the maximum is to be measured. On the other hand, if the maximum allowable error is only 2 per cent, then it is apparent from Table 6 that a second orifice must be used if the quantity of fluid to be measured is less than approximately 65 per cent of the maximum flow rate.

---

which height of mercury column can be read accurately.

Eliminating h_M between [b] and [c],

$$h = \frac{100\ (\triangle h)}{E_M\left(\dfrac{W_M}{W}\right)^2} \quad \ldots\ldots.[d]$$

Because of the square root relationship between flow rate and pressure difference, the per cent error in the flow rate is only one-half the per cent error in reading the manometer, or

$$E_F = \frac{1}{2}\,E_M \quad \ldots\ldots\ldots\ldots\ldots[e]$$

Eliminating E_M between [d] and [e],

$$h = \frac{50 \triangle h}{E_F\left(\dfrac{W_M}{W}\right)^2} \quad \ldots\ldots\ldots[f]$$

Assuming $\triangle h = ¼$ in.,

$$h = \frac{12.5}{E_F\left(\dfrac{W_M}{W}\right)^2} \quad \ldots\ldots\ldots[g]$$

The values in Table 6 were computed from [g].

PAW PERMITS OIL FOR REPLACEMENT BURNERS

Fuel oil may now be obtained for use in newly installed home heating burners if the new equipment replaces wornout or inefficient oil burners, PAW announced last month. Action to permit deliveries to the new oil burning facilities was taken by amending a formal PAW order (petroleum distribution order No. 13), which previously prohibited the delivery of home heating fuel oil to any new oil burner.

The action was taken to enable consumers to conserve fuel oil by increasing the efficiency of their burners. The amended order continues the ban on delivery of fuel oil to new oil burning equipment located in a home or establishment that previously did not have an oil burner.

Heating-Piping-Air Conditioning

AMERICAN SOCIETY *of* HEATING *and* VENTILATING ENGINEERS

Journal *Section*

50th Annual Meeting

January 31 - February 1 and 2

New York, N. Y.

★

HONORARY CHAIRMEN

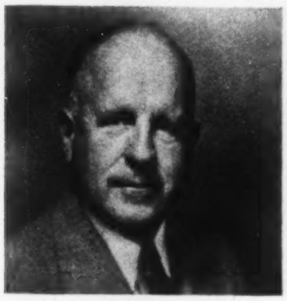
★

D. D. Kimball

Homer Addams

W. L. Fleisher

W. H. Carrier



W. H. Driscoll

PLANS FOR the 50th Anniversary Meeting of the Society are well under way and the Committee on Arrangements is preparing a program of special events for the business and technical sessions.

An active group of Committees has been announced by General Chairman Alfred J. Offner, with H. S. Wheller in charge of Hospitality; Mr. and Mrs. H. J. Ryan, Ladies; E. J. Ritchie, Sessions; Alfred Engle, Banquet; A. C. Buensod, Special Events; C. S. Pabst, Inspection; R. V. Sawhill, Publicity; C. F. Roth, N. Y. Chapter Special Committee; and W. M. Heebner, Finance.

Among the group of papers that have been offered for discussion are, a study of intermittent heating of churches, heat distribution in heating and cooling panels, air distribution problems, comfort data studies, engineering theories and practices for the past 50 years, and fuel conservation.

At the opening session the organization of the Society will be commemorated and a portion of this program will include the introduction of distinguished guests and the presentation of representatives of allied organizations. Reports of officers and committees will be presented and action will be taken on By-Law amendments.

A GREAT PAST **A GREATER FUTURE**

The headquarters selected for the 50th Annual Meeting is Hotel Pennsylvania at 32nd St. and 7th Ave., New York, where registration will commence on Monday, January 31, 1944. It is possible for only two Charter members of the Society to attend this meeting.

Preceding the business sessions there will be an opportunity for Council and Committee meetings.

The first Annual Meeting of the Society was a three-day meeting held in New York, and the advance program as published in the Sheet Metal Worker in January 1895 is reproduced, as well as the photos of the officers who were elected at this meeting.

There were six technical papers presented by leading authorities of that day, and in addition, a series of discussions of topics that were of special interest at the time were held. Vol. I of the Transactions of the Society presents the full discussion of these topics. These topical discussions were a feature of every meeting in the early years of the organization.

The preliminary meeting, at which the organization of the Society was planned, was held August 2, 1894 in the World Building, the organization meeting was held on September 10, 1894 in the Broadway-Central Hotel, and the first Annual Meeting, January 22-24, 1895 was in the headquarters of the American Society of Mechanical Engineers, 12 West 31st St., New York.

50th Annual Meeting
COMMITTEE ON ARRANGEMENTS

Alfred J. Offner, *General Chairman*

Honorary Chairmen—Homer Addams, W. H. Carrier, W. H. Driscoll, W. L. Fleisher, D. D. Kimball.

Banquet—Alfred Engle, *Chairman;* Russell Donnelly, *Vice-Chairman;* E. E. Ashley, R. W. Cumming, M. C. Giannini, Joseph Wheeler, Jr.

Finance—W. M. Heebner, *Chairman;* H. W. Fiedler, *Vice-Chairman;* R. R. Ferguson, G. E. Olsen.

Hospitality—H. S. Wheller, *Chairman;* W. J. Olvany, *Vice-Chairman;* T. N. Adlam, F. E. W. Beebe, H. H. Bond, Ernst Graber, E. B. Johnson, C. A. Miller, L. L. Munier, J. R. Murphy.

Inspection—C. S. Pabst, *Chairman;* P. B. Gordon, *Vice-Chairman;* H. L. Alt, J. A. Heller, M. H. Hirsch, F. D. Lawrence, Rudolph Pollak.

Ladies—Mr. and Mrs. H. J. Ryan, *Co-Chairmen*; H. S. Johnson, Mrs. R. H. Carpenter, Mrs. H. W. Fiedler, Mrs. W. L. Fleisher, Mrs. O. E. Frank, Mrs. A. V. Hutchinson, Mrs. C. S. Koehler, Mrs. G. E. Olsen, Mrs. R. A. Wasson.

N. Y. Chapter Special Committee—C. F. Roth, *Chairman;* J. G. Eadie, J. C. Fitts, C. S. Hoffman, H. C. Meyer, Jr., G. M. Scott.

Publicity—R. V. Sawhill, *Chairman;* Clifford Strock, *Vice-Chairman;* A. A. Bearman, C. H. B. Hotchkiss, O. O. Oaks, W. J. Osborn.

Sessions—E. J. Ritchie, *Chairman;* C. H. Flink, *Vice-Chairman;* E. E. Adams, S. R. Apt, Thomas Baker, P. G. Griess, G. D. Guler, C. R. Hiers, H. P. Waechter.

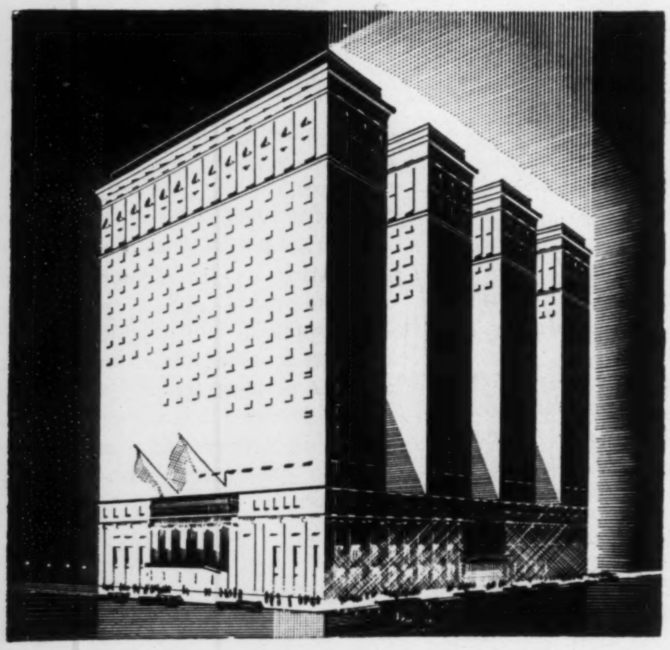
Special Events—A. C. Buensod, *Chairman;* A. F. Hinrichsen, *Vice-Chairman;* V. J. Cucci, C. A. Fuller, F. D. McCann, M. F. Rather, H. J. Rose, W. A. Sherbrooke.

Hotel Rates
(Per day)

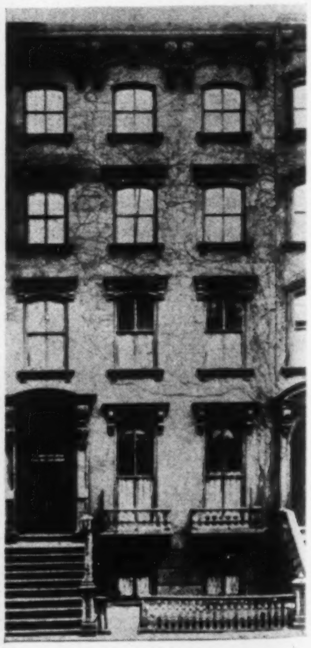
Single Room—$3.85, 4.40, 4.95, 5.50, 6.05, 6.60, and 7.70.

Double—(*Double Bed*) $5.50, 6.05, 6.60, 7.15, 7.70, 8.25, and 8.80.
(*Twin Beds*) $6.60, 7.15, 7.70, 8.25, 8.80, and 9.90.

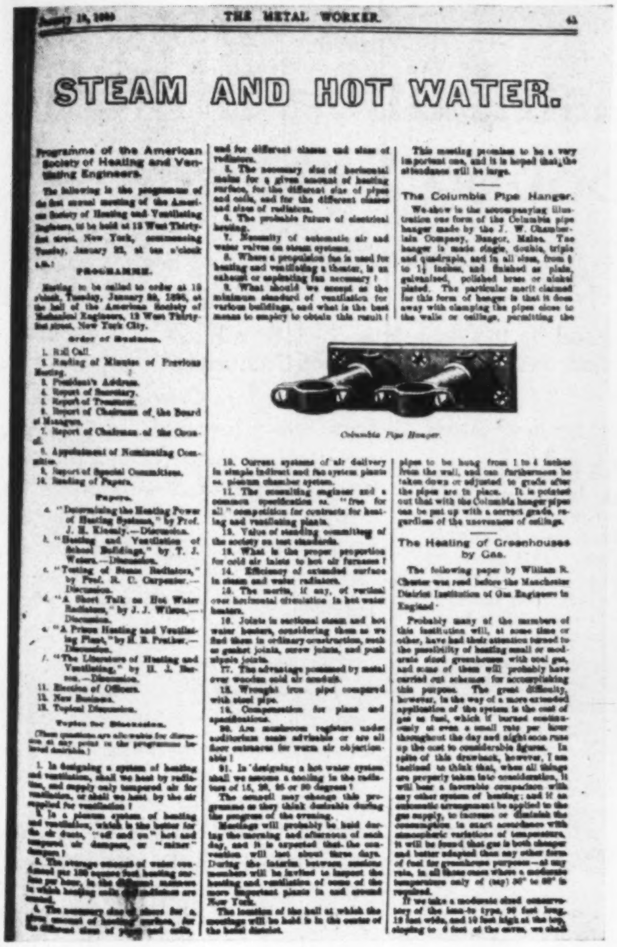
Suite—(*Living room, bedroom and bath*) $10.00, 11.00, and 13.00.



Hotel Pennsylvania, 50th Annual Meeting Headquarters



The Mechanical Engineering Library Building, 12 W. 31st St., New York, Scene of First Annual Meeting of ASHVE



January 18, 1896 THE METAL WORKER. 45

STEAM AND HOT WATER.

Programme of the American Society of Heating and Ventilating Engineers.

The following is the programme of the first annual meeting of the American Society of Heating and Ventilating Engineers, to be held at 12 West Thirty-first street, New York, commencing Tuesday, January 21, at ten o'clock a.m.:

PROGRAMME.

Meeting to be called to order at 10 o'clock, Tuesday, January 21, 1896, at the hall of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City.

Order of Business.

1. Roll Call.
2. Reading of Minutes of Previous Meeting.
3. President's Address.
4. Report of Secretary.
5. Report of Treasurer.
6. Report of Chairman of the Board of Managers.
7. Report of Chairman of the Council.
8. Appointment of Nominating Committee.
9. Report of Special Committees.
10. Reading of Papers.

Papers.

a. "Determining the Heating Power of Heating Systems," by Prof. J. H. Kinealy.—Discussion.
b. "Heating and Ventilation of School Buildings," by T. J. Waters.—Discussion.
c. "Testing of Steam Radiators," by Prof. R. C. Carpenter.—Discussion.
d. "A Short Talk on Hot Water Radiators," by J. J. Wilson.—Discussion.
e. "A Prison Heating and Ventilating Plant," by H. B. Prather.—Discussion.
f. "The Literature of Heating and Ventilating," by H. J. Barron.—Discussion.

11. Election of Officers.
12. New Business.
13. Topical Discussion.

Topics for Discussion.

(These questions are allowable for discussion at any point in the programme believed desirable.)

1. In designing a system of heating and ventilation, shall we heat by radiation, and supply only tempered air for ventilation, or shall we heat by the air supplied for ventilation?

2. In a plenum system of heating and ventilation, which is the better for the air ducts, "off and on" hot and tempered air dampers, or "mixer" dampers?

3. The average amount of water condensed per 100 square feet heating surface per hour, in the different manners in which heating coils and radiators are used.

4. The necessary size of risers for a given amount of heating surface, for the different sizes of pipes and coils, and for different classes and sizes of radiators.

5. The necessary size of horizontal mains for a given amount of heating surface, for the different size of pipes and coils, and for the different classes and sizes of radiators.

6. The probable future of electrical heating.

7. Necessity of automatic air and water valves on steam systems.

8. Where a propulsion fan is used for heating and ventilating a theater, is an exhaust or aspirating fan necessary?

9. What should we accept as the minimum standard of ventilation for various buildings, and what is the best means to employ to obtain this result?

Columbia Pipe Hanger.

10. Current systems of air delivery in simple indirect and fan system plants vs. plenum chamber system.

11. The consulting engineer and a common specification vs. "free for all" competition for contracts for heating and ventilating plants.

12. Value of standing committee of the society on test standards.

13. What is the proper proportion for cold air inlets to hot air furnaces?

14. Efficiency of extended surface in steam and water radiators.

15. The merits, if any, of vertical over horizontal circulation in hot water heaters.

16. Joints in sectional steam and hot water heaters, considering them as we find them in ordinary construction, such as gasket joints, screw joints, and push nipple joints.

17. The advantage possessed by metal over wooden cold air conduits.

18. Wrought iron pipe compared with steel pipe.

19. Compensation for plans and specifications.

20. Are mushroom registers under auditorium seats advisable or are all floor entrances for warm air objectionable?

21. In designing a hot water system shall we assume a cooling in the radiators of 15, 20, 25 or 30 degrees?

The council may change this programme as they think desirable during the progress of the evening.

Meetings will probably be held during the morning and afternoon of each day, and it is expected that the convention will last about three days. During the interim between sessions members will be invited to inspect the heating and ventilation of some of the more important plants in and around New York.

The location of the hall at which the meetings will be held is in the center of the hotel district.

This meeting promises to be a very important one, and it is hoped that the attendance will be large.

The Columbia Pipe Hanger.

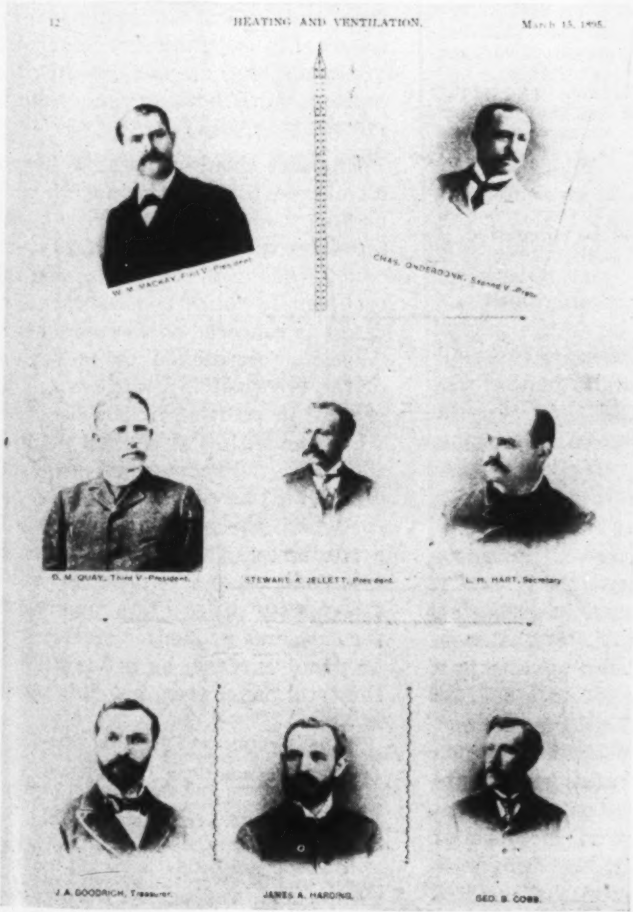
We show in the accompanying illustration one form of the Columbia pipe hanger made by the J. W. Chamberlain Company, Bangor, Maine. The hanger is made single, double, triple and quadruple, and in all sizes, from ½ to 1½ inches, and finished as plain, galvanized, polished brass or nickel plated. The particular merit claimed for this form of hanger is that it does away with clamping the pipes close to the walls or ceilings, permitting the pipes to be hung from 1 to 4 inches from the wall, and can furthermore be taken down or adjusted to grade after the pipes are in place. It is pointed out that with the Columbia hanger pipes can be put up with a correct grade, regardless of the unevenness of ceilings.

The Heating of Greenhouses by Gas.

The following paper by William R. Chester was read before the Manchester District Institution of Gas Engineers in England:

Probably many of the members of this institution will, at some time or other, have had their attention turned to the possibility of heating small or moderate sized greenhouses with coal gas, and some of them will probably have carried out schemes for accomplishing this purpose. The great difficulty, however, in the way of a more extended application of the system is the cost of gas as fuel, which if burned continuously at even a small rate per hour throughout the day and night soon runs up the cost to considerable figures. In spite of this drawback, however, I am inclined to think that, when all things are properly taken into consideration, it will bear a favorable comparison with any other system of heating; and if an automatic arrangement be applied to the gas supply, to increase or diminish the consumption in exact accordance with atmospheric variations of temperature, it will be found that gas is both cheaper and better adapted than any other form of fuel for greenhouse purposes—at any rate, in all those cases where a moderate temperature only of (say) 50° to 60° is required.

If we take a moderate sized conservatory of the lean-to type, 20 feet long, 12 feet wide, and 10 feet high at the top, sloping to 6 feet at the eaves, we shall



12 HEATING AND VENTILATION. March 15, 1895.

W. M. MACKAY, First V. President

CHAS. ONDERDONK, Second V.-Pres.

D. M. QUAY, Third V.-President.

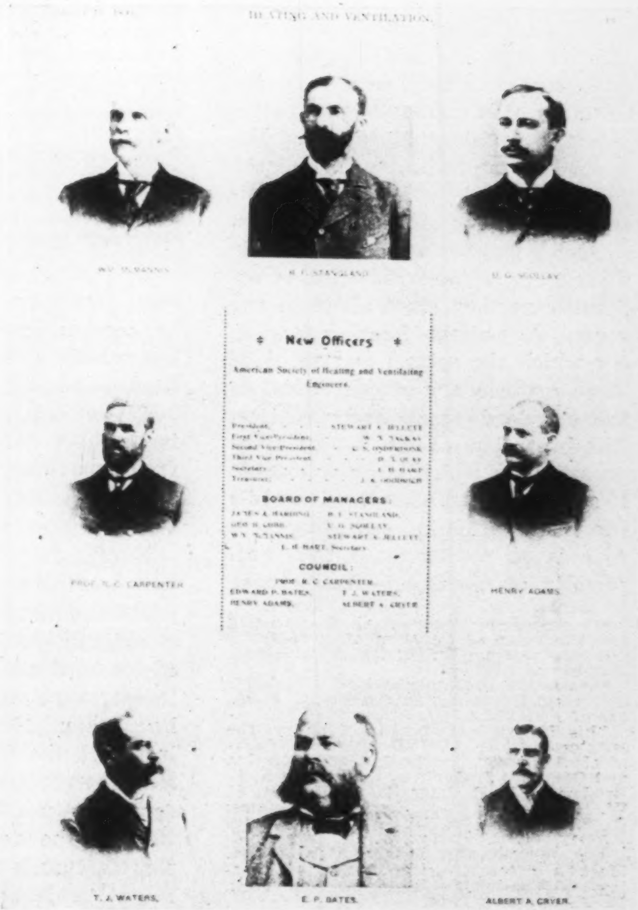
STEWART A. JELLETT, President.

L. H. HART, Secretary.

J. A. GOODRICH, Treasurer.

JAMES A. HARDING.

GEO. B. COBB.



HEATING AND VENTILATION.

W. V. McMANNIS.

R. C. STANGLAND.

D. G. SCOLLAY.

New Officers

American Society of Heating and Ventilating Engineers.

President, - - - STEWART A. JELLETT.
First Vice-President, - W. M. MACKAY.
Second Vice-President - C. S. ONDERDONK.
Third Vice-President - - D. M. QUAY.
Secretary, - - - - L. H. HART.
Treasurer, - - - - J. A. GOODRICH.

BOARD OF MANAGERS:

JAMES A. HARDING. R. C. STANGLAND.
GEO. B. COBB. D. G. SCOLLAY.
W. V. McMANNIS. STEWART A. JELLETT.
L. H. HART, Secretary.

COUNCIL:

PROF. R. C. CARPENTER.
EDWARD P. BATES. T. J. WATERS.
HENRY ADAMS. ALBERT A. CRYER.

PROF. R. C. CARPENTER.

HENRY ADAMS.

T. J. WATERS.

E. P. BATES.

ALBERT A. CRYER.

Optimum Surface Distribution in Panel Heating and Cooling Systems

By B. F. Raber[*] and F. W. Hutchinson[**]
Berkeley, Calif.

(Second progress report of research sponsored by the American Society of Heating and Ventilating Engineers in cooperation with the University of California.)

SUMMARY—The authors have measured the area enclosed by a line drawn on a chart by a special integrating instrument emitting a beam of light which was directed around the visible contour of a full sized model representing a human being. The area so determined represents, it is claimed, that proportion of the emitted radiant energy which reached the model.

The total radiant heat received from any selected area of emitting surface was obtained by dividing the surface into a large number of small areas and totalling the energy received from each small area.

Determinations of energy received were made for the model representing a standing human figure in a front, 45 deg front and side view position, and for a sitting human figure in a front, 45 deg rear and rear view position.

It was found that even with a low ceiling (8 ft) the maximum amount of energy reaching an occupant was less than five per cent of that emitted by the panel. If the emitting surface was located more than six feet from the model the amount of radiant energy received was less than two per cent, and if the distance was eight feet the amount was less than one per cent. The radiant energy received from surfaces more than 10 or 15 ft from the occupant was extremely small. An example is given to show how the total radiant energy received from any panel could be calculated.

Introduction

Any heating system designed to provide occupant comfort by control of radiant energy exchange must, to be effective, satisfy three fundamental conditions. These are:

1. To relate the mean radiant temperature (MRT) of the enclosure to the air temperature (t_a) in such a way that the comfort equation will be satisfied.
2. To utilize a maximum irradiation, Btu/(hour) (sq ft of occupant), less than that at which discomfort is first experienced.
3. To distribute the basic radiating surface in a manner such that direct irradiation of the occupant will be satisfactorily uniform for all parts of the conditioned enclosure.

Applied to the design of a panel heating system, the criteria given require determination of the minimum panel area needed to maintain an adequate MRT under conditions of maximum heat loss; the selection of a maximum panel temperature sufficiently low so that the intensity of radiation from the panel will not be objectionable; distribution of the design panel area in such a manner as will avoid wide divergence in the irradiation of occupants as they move about in the room. A radiant heating system for which the second and third of these criteria are often critical is the standard residential fireplace. The high flame temperature gives an intensity which is objectionable to anyone seated near the fire while the distribution of radiating *surface* is so concentrated that uniformity of heating is likely to be very poor. Under such conditions an occupant may be in a position for which a satisfactory over-all heat balance is established on his body, yet one part of the body will be subject to discomfort arising from extreme irradiation while, simultaneously, another part is uncomfortably cold.

Except in the case of incandescent heating surfaces, the intensity problem does not arise in designing a radiant heating system. Panels of conventional design operate in a temperature range (80 to 180 F for heating and 50 to 70 F for cooling) in which the intensity is not outside the comfort range and therefore need not be given consideration by the designer. Because of this fortunate fact, the designer's attention is sometimes distracted from the unfortunate fact that *uniformity* is a factor of genuine practical importance and one which requires careful consideration if the system is to provide comfort irrespective of the position of the occupant in the enclosure. Fundamentally, the procedure in designing a panel system is first to select a design maximum panel surface temperature, then calculate the required panel area and, lastly, distribute this area of panel in a manner—determined from the geometry of the heated space—such that uniformity will be attained. The first and second steps in panel design have been discussed in earlier papers.[1] The intent of the present paper is to provide basic design data and indicate a rational procedure for carrying out the third necessary step in the design of a comfort panel heating (or cooling) system.

The fact should constantly be remembered that in the design step having to do with uniformity, the absolute value of the energy exchange between the panel and the occupant is not of consequence; interest is centered on the percentage variation occasioned by movement of the occupant in the room (or by change in position of the occupant when remaining at a fixed point in the room). The most effective design will, in every case, be the one for which the per cent variation is a minimum. The absolute value of the radiant energy exchange between occupant and panel will vary, for the same geometric distribution of panel surface, as a function of the total panel area, but this varia-

---

[*] Professor of Mechanical Engineering and Chairman of Department of Mechanical Engineering, University of California. Member of ASHVE.

[**] Assistant Professor of Mechanical Engineering, University of California. Member of ASHVE.

This report was prepared under the auspices of the ASHVE Research Technical Advisory Committee on Radiation and Comfort: J. C. Fitts, Chairman; E. L. Broderick, R. E. Daly, L. N. Hunter, F. W. Hutchinson, A. P. Kratz, John James, C. S. Leopold, D. W. Nelson, G. W. Penney, W. R. Rhoton, T. H. Urdahl.

For presentation at the 50th Annual Meeting of the American Society of Heating and Ventilating Engineers, New York, N. Y., January 1944.

[1] Panel Heating and Cooling Analysis, by B. F. Raber and F. W. Hutchinson. (ASHVE Transactions, Vol. 47, 1941.)

Panel Heating and Cooling Performance Studies, by B. F. Raber and F. W. Hutchinson. (ASHVE Transactions, Vol. 48, 1942.)

Trend Curves for Estimating Performance of Panel Heating Systems, by B. F. Raber and F. W. Hutchinson. (ASHVE Transactions, Vol. 48, 1942.)

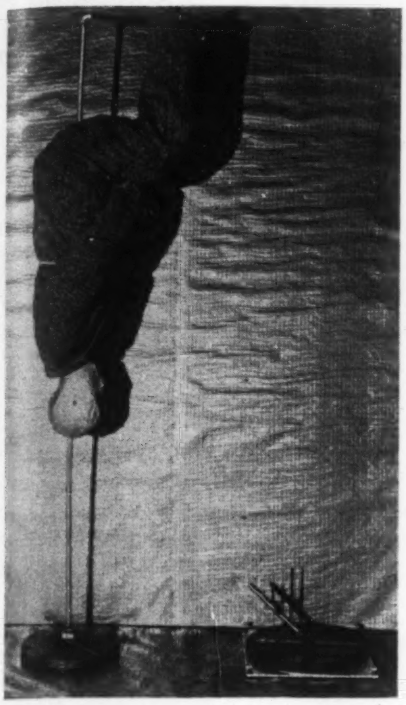


Fig. 1—Dummy subject in seated posture and the mechanical integrator

tion is inherent in the heat transfer characteristics of the particular system and is, therefore, not a factor amenable to treatment from the standpoint of distribution design. Distribution, fundamentally, is fixed in terms of the space relationships between the occupants and the panels; for a room of fixed plan and ceiling height there is, therefore, a particular panel pattern which, irrespective of panel design temperature or of panel area, will give greatest uniformity of direct exchange between occupant and primary radiating (or, for panel cooling, receiving) surface. Thus the problem of designing for uniformity of heating effect reduces to one of geometry rather than heat transfer and permits realization of a series of geometrical solutions which are applicable to systems having any heat loss characteristics.

This generalization of the distribution problem enormously simplifies the work of the designer, since it permits solution of the two basic design problems independently of one another. A knowledge of the ventilation and heat transfer characteristics of the structure permits determination of the necessary panel area (operating at design temperature) without consideration of the shape of room or location of panels. Consideration of the geometry of the system permits determination of the optimum panel pattern. Distribution of known panel area in a known pattern is then a matter of simple arithmetic to fix the width of panel per lineal foot of pattern.

Although knowledge of the absolute radiant energy exchange between panel and occupant is unimportant in conventional panel heating systems, there are special installations for which such information may be of great importance. In the conventional system, as for a residence or office building, the primary purpose of the panel is to establish the desired MRT; this is accomplished largely by radiant exchange between walls and panel; the direct energy flow from panel to occupant is consequently of only minor importance. In many special cases, however, the use of panels to raise the MRT of the entire enclosure may be impractical or uneconomical and in such instances direct energy transfer to or from the occupant can be resorted to as a method of establishing localized or "spot" heating or cooling. Systems of this kind find use in industry for marine installations (as in engine rooms or galleys) and seem also to offer intriguing possibilities for use in the cabins and cockpits of airplanes intended for high altitude operation. Design of such installations requires knowledge of the absolute exchange rate of energy between panel and subject; fortunately the same basic experimental data (reported in this paper) which are necessary for solving the problem of uniform energy distribution are also adequate for use in calculations of absolute exchange rates.

Experimental Procedure

Distribution of panel area for optimum uniformity of heating requires knowledge of the variation in direct radiant energy exchange between the occupant and the panel as the occupant varies his position with respect to the panel. Since the exchange rate, for a fixed position of the occupant, is the sum of the exchange rates for all unit areas of the panel, the problem resolves itself into a determination of the exchange variation between a fixed unit area (or infinitesimal area) of panel and a moving occupant. More simply, the experimental data can be collected for a system in which the occupant retains a fixed position and the element of panel is moved. If the human body were cylindrical the experimental procedure would reduce, for a fixed ceiling height, to determination of exchange between the cylinder and an elementary ceiling area as that area moved radially outward from the center line of the cylinder. But the human form markedly differs from that of a cylinder and it is therefore necessary to investigate exchange rates not only for radial variation of the elementary area but also for variation circumferentially. For a subject in a sitting position experimental determinations are necessary through 180 deg, but for a standing subject experiment showed that no material difference in exchange rates occurs outside of that included in the 90 deg range from full face to full profile. Further, the circumferential variation was found to proceed without marked discontinuity so that the experimental procedure could be reduced to determinations for three angles for the standing figure (full face, 45 deg off of full face, full profile) and for only two additional angles (full rear and 45 deg off of full rear) for the seated figure.

Assuming that the panel is a diffuse surface source, exchange rate variation is a function of the cosine of the angle, ø, between a normal to the panel surface and a line connecting the center of the elemen-

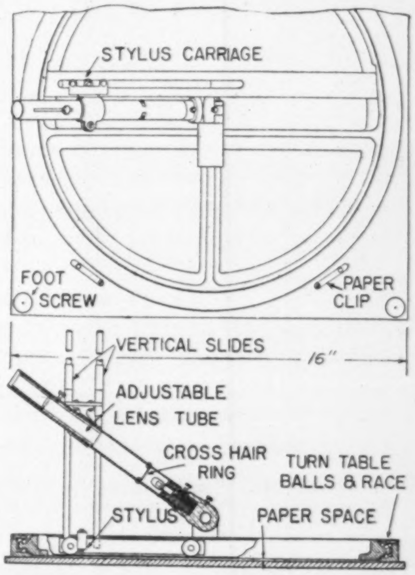


Fig. 1a—The mechanical integrator

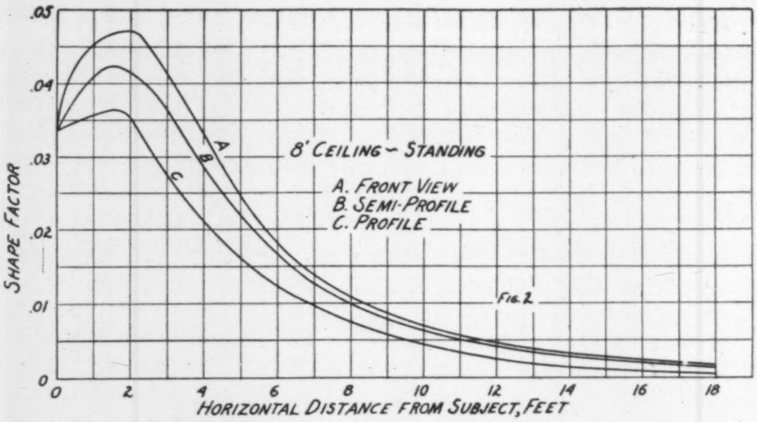


Fig. 2—Fraction of energy reaching a standing subject from an elemental panel area in an 8 ft ceiling

tary emitter and receiver areas (see Appendix for equations) and is also a function of the projected area of the receiver on a plane normal to the line connecting emitter and receiver; by the inverse square law the shape factor is also an inverse function of the length of this line squared. For an elementary panel area the exchange rate variation (as a function of subject position) thus depends on integration, over the area of the subject *seen* by the elementary panel area, of the product cos ø by the projection of the corresponding elementary area of the subject and the inverse of the distance squared. Evaluation of this integral by analytical methods is impractical for a receiver surface as complex as that represented by the human body. Thus the need arises for experimental integration by laboratory means.

The data presented in this paper were obtained by use of a mechanical integrator of a type proposed by Hottel[2] and developed by Boelter[3]; a view of this instrument appears in lower right, Fig. 1 (see scale drawing Fig. 1a). As used in the laboratory, the integrator was placed directly over the point selected to represent the center of the elementary panel area. From this position a beam of light from the integrator was directed around the outline of the subject. For each such determination the integrator drew a closed curve on a piece of paper; the area within the curve was determined with a planimeter and divided by a constant to obtain the shape factor which is equal to the fraction of energy received by the subject of that emitted by the elementary panel.

Convenience in operation of the integrator required greater accessibility than could have been obtained if the integrator had been moved about on the ceiling. Therefore it was decided to *invert* the system, placing the subject in a head down position with feet on or near the research room ceiling and moving the integrator from point to point on the floor of the room. An additional advantage of this inverted system (see Fig. 1) is that it permitted simple variation in *ceiling* height; this height being, in each case, the vertical distance from the feet of the dummy to the floor of the research room.

Concern was also felt for the variations in body size among subjects and variation in form between the male and female figure. No attempt has been made to take account of such variations; the data presented are, without exception, taken from an *average* male subject of height 5 ft 10 in. and weight 165 lb. From a study of the experimental shape factors for such a figure the effect of change in height can be estimated.

Experimental Results

Ceiling Panels. The first group of tests were conducted for a *standing subject* located in a room with ceiling panels. Ceiling heights of 8 ft, 10 ft, and 12 ft were investigated. Fig. 2 gives the results for an 8-ft ceiling. For a fixed position of the subject the three curves of this figure give the variation in fraction of energy which reaches the subject from a panel of elementary area as it is moved out from the vertical center line of the subject. The abscissa can, of course, be considered to represent either the horizontal distance of unit panel from a fixed subject or of subject from a fixed unit panel.

Two items of particular interest are evident from this figure:

1. Even with a low (8 ft) ceiling, the maximum fraction of energy leaving a panel element and reaching an occupant of a panel-heated room is less than 5 per cent. The fraction contributed by heated surface situated more than 6 ft radially out from a subject is less than 2 per cent while for radial distances exceeding 8 ft less than 1 per cent energy leaving the panel passes directly to the occupant.
2. Maximum exchange does not occur when the occupant is directly under the elementary area. When in this position the panel *sees* only the head and shoulders of the subject and the consequent reduction in projected area exceeds the advantage due to a smaller average angle ø. As the subject moves out from directly under the elementary panel area a rapid increase in projected body area takes place until, for a radial distance of from 1½ ft to 2 ft, the maximum exchange rate is realized. For distances beyond 2 ft the projected area continues to increase for a short interval and then rapidly decreases with distance, but even in the short increasing interval the product of projected area, cos ø, and the inverse of distance squared is found to decrease.

Thus the typical shape factor curve for a standing figure is in three distinct parts; in the first part increasing projected area controls and the shape factor becomes greater; in the second part increasing area is more than offset by

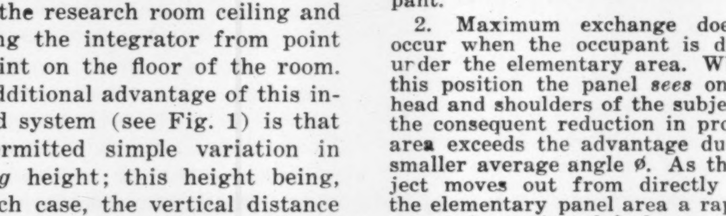
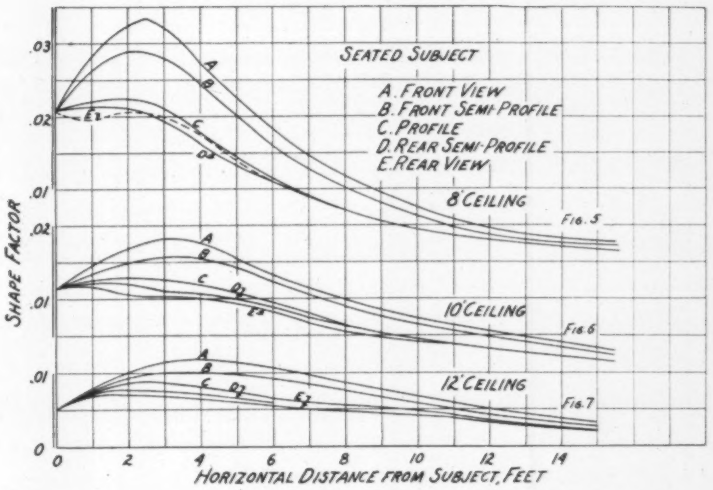


Fig. 3—Fraction of energy reaching a standing subject from an elemental panel area in a 10 ft ceiling

---

[2] Radiant Heat Transmission, by H. C. Hottel, *Mechanical Engineering*, Vol. 52.

[3] A Mechanical Integrator for the Determination of the Illumination from Diffuse Surfaces Sources, by V. H. Cherry, D. D. Davis, L. M. K. Boelter, Transactions, *Illuminating Engineering Society*, 1939.



Figs. 5, 6, 7—Fraction of energy reaching a seated subject from an elemental panel area in an 8 ft, 10 ft, or 12 ft ceiling

rapidly increasing cos ϕ and increasing distance; in the last part, the changes in projected area and in cos ϕ are less significant than the effect of distance.

A three-dimensional solid, the height representing shape factor, would be obtained if the curve for profile were rotated 90 deg with respect to the plane of the page (Fig. 2) and the curve for semi-profile were rotated 45 deg with respect to the same plane. The slope of the surface for such a solid would approach variation by the inverse square law for radial distances greater than approximately 12 ft. Note that at a distance of 18 ft out from the elementary area, the exchange rate has dropped to approximately one-eighth of its maximum; thus a variation of over 800 per cent occurs in direct heating effect as one moves out 18 ft from an elementary ceiling panel located in a room of 8 ft height.

Fig. 3 is for a standing subject with ceiling panels in a room having a 10 ft ceiling, while Fig. 4 is for a similar subject in a room with 12 ft ceiling. The radial distance for maximum exchange is seen to increase from 1½ ft to 3 ft to 5 ft as the ceiling height increases from 8 ft to 10 ft to 12 ft. Absolute energy exchange rate falls off very rapidly with ceiling height so that for a 12 ft ceiling only one-half of one per cent of the energy leaving the elementary panel area is received by a subject standing directly below, while at 18 ft the amount received is less than one-quarter of one per cent.

The second group of ceiling panel tests were for a subject in *seated position* in rooms with ceilings of 8 ft, 10 ft, and 12 ft; data for these cases are given in Figs. 5, 6, 7, respectively. The previous discussion of the data for a standing subject is also applicable to these three sets of curves with the addition of a note concerning a peculiarity of the curve for back view of a seated figure in a room having 8 ft ceiling height. For this one case it is observed that a reflex occurs in the curve as the subject moves radially outward from a position directly under the panel. This characteristic results from the fact that, when directly under the panel, the thighs and knees of the seated subject contribute to the projected area; as radial movement occurs this section of the subject's body is rapidly shielded by his head, shoulders and back so that, for a brief interval, the increase in projected area due to exposure of the back is more than offset. Soon, however, the thigh area is completely shielded; increasing exposed back area then causes the shape factor to increase for a short radial distance before the usual maximum and subsequent reduction sets in. For the 10 ft and 12 ft ceilings this inversion of the curve is not noted though some evidence of the "thigh effect" does appear in two of the curves of Fig. 6.

Comparing Figs. 2 and 5 shows that, for the same ceiling height, radiant exchange to a subject directly under an element of panel is much greater when the subject is standing than when he is sitting. At first glance this may seem surprising since the projected body area is greater for the seated subject, but the greater average distance of the seated subject more than offsets the increased area. At radial distances greater than 6 ft, the differences in exchange for the seated and standing positions are practically negligible.

Wall Panels. The variation in shape factor of the subject with respect to an elementary area of wall panel is very much more difficult to evaluate than for ceiling panels. For this case the experimental work was limited to investigation of vertical wall panels located in a plane making a 90 deg horizontal angle (90 deg in plan view of the room) with the straight line connecting the element of area to the feet of the standing subject (see Fig. 8). Data were obtained for full face and for profile positions of the subject with respect to the panel and for elements of area located at horizontal distances of 2 ft, 4 ft, 6 ft, 8 ft, 10 ft, and 12 ft from the subject and at 2 ft, 4 ft, 6 ft, 8 ft, 10 ft, and 12 ft distances above the floor. The results of the experimental work are shown in Figs. 9 and 10.

Extension of the experimental data to cases where the subject faces an element of panel which is in a plane having a normal which makes a horizontal angle β with a straight line connecting the element and the feet of the subject (see Fig. 8) can be readily accomplished by obtaining the shape factor from the experimental curves for an equivalent distance L equal to the actual distance L ft and multiplying this factor by cos β. Thus, referring to Fig. 8, the shape fac-

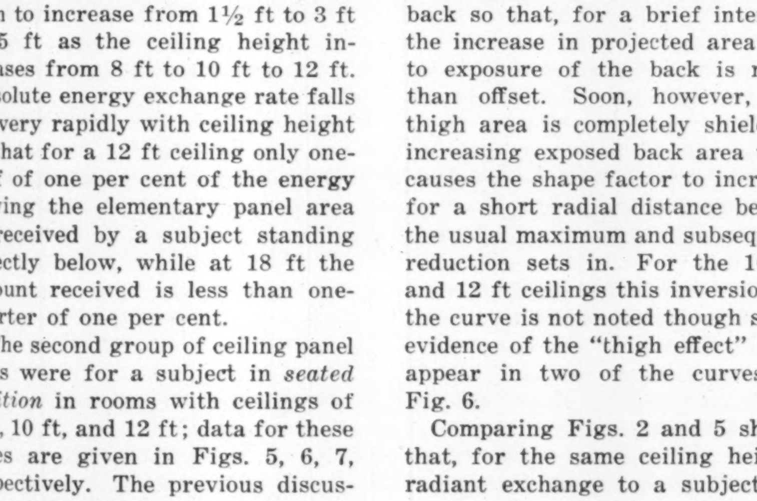


Fig. 4—Fraction of energy reaching a standing subject from an elemental panel area in a 12 ft ceiling

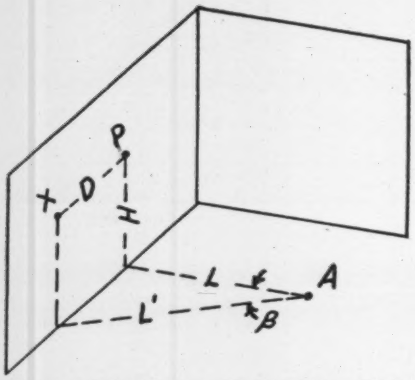


Fig. 8—The floor angle β within which wall panels as at X were considered; subject with feet at A

tor at any point X is given in terms of the experimentally determined shape factor at P by the equation,

$$F_X = F_P \cos\beta = F_P \frac{L}{\sqrt{L^2 + D^2}}$$

Shape factors for the range of values of D, H, and L which are of practical significance have been computed by Charles F. Dischler and are presented in Tables 1 and 2 for full face and profile positions, respectively. From these tabular point values the over-all shape factor of a subject with respect to a wall panel of any size and shape can be obtained by summing the tabular shape factor at mid-points of small equal area elements of the panel and then dividing the sum by the number of elements so considered. This method does not give an exact result because it does not permit taking into account the variation from full face (or from profile) of the figure, but the inaccuracy is unlikely to be of practical significance and can, if necessary, be reduced by interpolating for each value of D/L between the corresponding tabular values for full face and profile positions.

Floor Panels. The maximum operating temperature of floor panels is so much lower than for ceiling panels and the fraction of convective heat transfer so much greater, that direct irradiation of the subject in such a panel system is likely to be insignificantly small. For this reason the experimental work necessary for obtaining shape factor data for floor panels could not be justified. Inspection of Figs. 2, 3, and 4 for ceiling panels reveals, however, that the non-uniformity of primary irradiation varies inversely as ceiling height. Since a floor system is approximately equivalent to a ceiling system in a room having 6 ft ceiling height (the degree of the approximation being represented by the difference in shape of a subject standing normally from one standing on his head) it appears evident that reasonable uniformity of direct irradiation from floor panels would be practically impossible of attainment. Fortunately the low temperature and small direct irradiation fraction in floor systems makes this non-uniformity less important than in wall and ceiling systems where greater departures from the characteristics of conventional convective systems is attained.

Optimum Panel Distribution for Uniformity of Primary Irradiation

Calculation of Absolute Shape Factors. The experimentally determined basic shape factor data have two distinct fields of usefulness. The first is in calculating the over-all shape factor of a subject in given position with respect to a panel of any shape and size. For this purpose the plan view of the panel is drawn to scale and the panel then arbitrarily divided into small equal area elements; the smaller the element of area the greater will be the accuracy of the calculated result, but for practical design purposes there is never need for taking elements less than one square foot and in many cases squares two feet on the side will give results of reasonable accuracy. The location of the subject is fixed on the plan view and the horizontal distance from subject to center of each elementary area is then scaled. For a room of known ceiling height and for a particular facing direction the shape factor of subject with respect to each unit of area can be determined, for the scaled horizontal distance, by interpolation between the shape factor curves for profile, semi-profile and full face. Adding the factors so determined and dividing by the number of equal area elements gives the average unit area shape factor which is numerically identical with the shape factor of the subject with respect to the entire panel.

A numerical example of such an absolute shape factor determination is illustrated in Fig. 11. The subject is standing at point P in a room 11 ft x 11 ft with 8 ft ceiling height. The entire ceiling is acting as a heating panel at uniform surface temperature and the shape factor of subject with respect to ceiling is desired. As shown in the figure, the ceiling is divided into elementary areas of 1 sq ft each. The distance from center of each such area to the subject is then scaled and the corresponding shape factor obtained from Fig. 2 and recorded in its proper square. The variation from full face to profile position was neglected in this example and all data recorded for a semi-profile view of the subject. Except in cases where precise investigation for some special purpose is required, the asssumption of a semi-profile view seems to be a reasonable average approximation for all cases and will be used as such in all numerical examples given in this paper. For the case now being considered the required

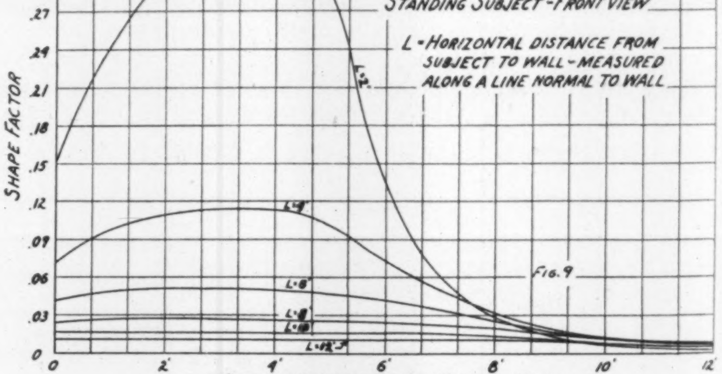


Fig. 9—Fraction of energy reaching front of standing subject from an elemental panel area in a wall

shape factor is equal to 1/121 of the sum of all unit area factors; the result is thus, 1.7275 ÷ 121 = 0.0143 = 1.43 per cent, that is, slightly less than one and a half per cent of the total energy leaving the ceiling is directly received by the subject.

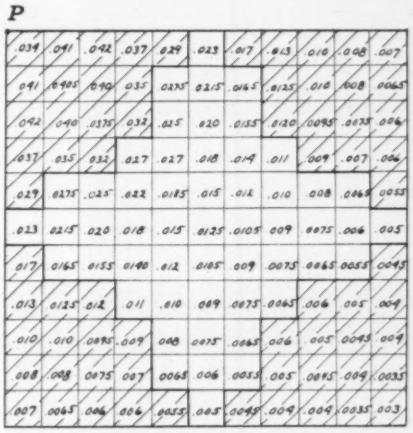
As a second example consider a heating surface made up only of the shaded sections in Fig. 11; the shape factor for such a panel is, again, the sum of factors for all heated elements divided by the number of such elements 1.0050 ÷ 68 = 0.0148 = 1.48 per cent. In a similar manner Fig. 11 will provide data to calculate the shape factor of the subject, when at *P*, with respect to any shape of panel. A further usefulness of the data from this figure arises from the fact that each unit area factor can be regarded as for a subject standing at center of that area with respect to a panel of unit area located in the square containing *P*.

Tabulations similar to that of Fig. 11 can be prepared for as many subject positions as are of interest. The method is, in every case, simple and straight-forward, but the numerical work is tedious and the procedure time-consuming. Ordinarily, a detailed analysis of this kind need not be carried out for conventional systems which are amenable to the generalized treatment developed in a subsequent section of this paper, but the method does find practical usefulness in the design of spot heating or cooling systems for which direct radiant energy exchange between the panel and the subject in a fixed position is of controlling importance.

Generalized Distribution Patterns. Of far greater practical significance than for calculation of absolute shape factors is the use of the basic experimental data as a means of investigating the general effect of panel area distribution on the uniformity of direct radiant exchange between the panel and a subject moving about in the enclosure. The curves showing variation of basic factor with location of the subject bring out the fact that radiating surface more than 10 or 15 ft from the subject contributes very little to the magnitude of irradiation which is experienced. From this it follows that the variation in primary exchange which occurs as an occupant moves around in a panel heated room is practically independent of room size (beyond a minimum value) but is governed by the varying pattern of that part of the total panel which is within a 10 or 15 ft radius from the occupant's instantaneous position.

Even if the entire ceiling is heated this pattern will still be subject to change since for a centrally located occupant direct radiation is received from all sides, but for an occupant in a position near one of the walls the 15 ft radius pattern gives no heating from one side and much from the other. The basis of the investigation of optimum generalized patterns thus reduces to a study of the manner in which the shape factor of the occupant varies with respect to that part of the total panel area which, for any occupant position, lies within the critical radius. Thus the shape and size of the room (beyond a minimum size, to be established for each ceiling height) are only of secondary importance and the major interest centers on variation of direct irradiation experienced by an occupant as he takes up successive positions along perpendicular center lines in a generalized room of any size and shape.

Further simplification of the problem is attained by shrinking the panel width down to a line (the panel center line) and investigating the effect on uniformity of a variation in the center line pattern only. By this artifice generalized results are obtained which are exact only for real panels of small width, but which lead to conclusions of adequate engineering accuracy for use with actual panels of any necessary width. The entire study can then be conducted in terms of center lines; the final generalized pattern is applied to a particular room to obtain the lineal feet of optimum panel and this figure then divided into the requisite panel area (determined by solution of the heat balance equations) to determine the necessary width of panel for that room.



P

.034	.041	.042	.037	.029	.023	.017	.013	.010	.008	.007
.041	.0405	.040	.035	.0275	.0215	.0165	.0125	.010	.008	.0065
.042	.040	.0375	.032	.025	.020	.0155	.0120	.0095	.0075	.006
.037	.035	.032	.027	.027	.018	.014	.011	.009	.007	.006
.029	.0275	.025	.022	.0185	.015	.012	.010	.008	.0065	.0055
.023	.0215	.020	.018	.015	.0125	.0105	.009	.0075	.006	.005
.017	.0165	.0155	.0140	.012	.0105	.009	.0075	.0065	.0055	.0045
.013	.0125	.012	.011	.010	.009	.0075	.0065	.006	.005	.004
.010	.010	.0095	.009	.008	.0075	.0065	.006	.005	.0045	.004
.008	.008	.0075	.007	.0065	.006	.0055	.005	.0045	.004	.0035
.007	.0065	.006	.006	.0055	.005	.0045	.004	.004	.0035	.003

Fig. 11—Absolute shape factor determination for a subject at P in a Room 11 ft x 11 ft with an 8 ft ceiling

Before proceeding to the search for generalized patterns a brief investigation of the relationship between point and line panels and the influence of panel length on variation in uniformity along lines normal to, and parallel to, the line panel is in order. From such an investigation further simplifications in procedure will become evident. Fig. 12 compares the shape factor variation experienced by a subject moving along a 10 ft center line when irradiated by means of either one or two point panels (panels of small area, as one square foot) located at the ends, the middle, or to one side of the center line; the data are for an 8 ft ceiling and can be verified either by reference to the curve of Fig. 2 or the table of Fig. 11.

Curve A of Fig. 12 shows the per cent of maximum shape factor for points along the center line when irradiation is from a single point

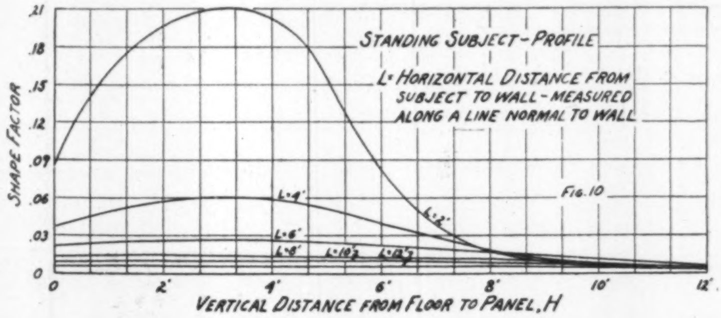


Fig. 10—Fraction of energy reaching side of standing subject from an elemental panel area in a wall

panel located in the ceiling directly over the left end of the center line. The shape of this curve is identical with that obtained experimentally and the non-uniformity of heating effect—from 16 per cent to 100 per cent—is obviously very serious. Curve B shows the variation when the point panel is moved to a position at the middle of the center line. For this case the maximum variation is from 55 per cent to 100 per cent and for the 6 ft section of center line terminating 2 ft in from either end the maximum variation is reduced to 20 per cent (varying from 80 per cent to 100 per cent of the maximum absolute value).

Curves C and D are for twin point panels. In Curve C the points are located 5 ft to right and left of the center line on a line normal to its mid-point; the maximum variation is 44 per cent, just as for Curve B, but the distribution is now changed so that the maximum occurs at the mid-point of the center line. This type of distribution is characteristic of off-center point panels and will be shown also to closely represent the typical distribution for line panels parallel to the center line. Curve D gives the least variation, 20 per cent, of any point grouping shown in the figure. Comparing Curves B and D shows that location of the points away from the center serves to remove a large part of the drooping end characteristic which appears for B and C; further study will show that there is an optimum point spacing at which the end droop is a minimum for each particular ceiling height.

By adding consecutive point shape factors and dividing by the number of points considered, line shape factors can be obtained. Fig. 13 shows the variation along a 10 ft center line due to 10 ft line panels located in an 8 ft ceiling, parallel to the center line, but at varying distances out from it. Curves A, B, and C are, respectively, for a single line panel located 0 ft, 5 ft, and 10 ft off center. Note that the maximum variation is reduced from 31 to 25 per cent to 15 per cent as the panel is moved out—this characteristic is typical of off-center parallel panels and is helpful to the designer since it means that the selection of a

Table 1—Shape Factors of Subject in Full Face with Respect to Element of Wall Panel

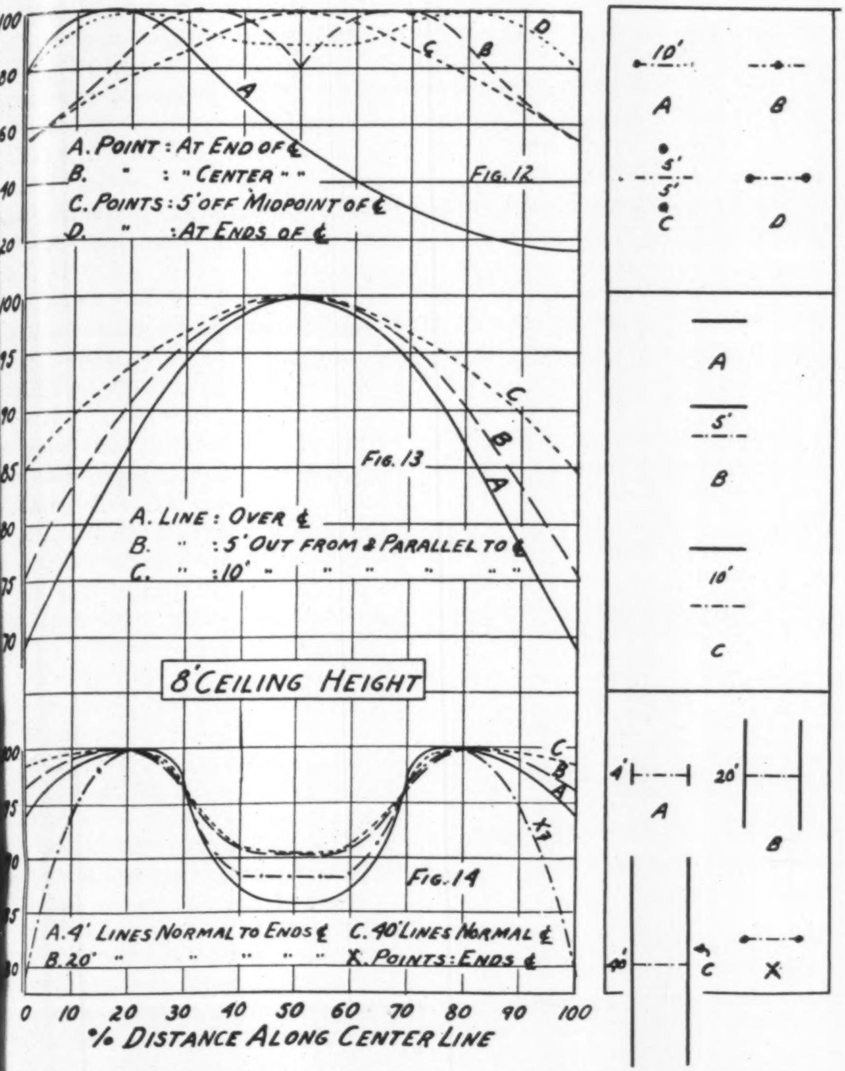
L = Length of normal from wall to feet of subject.
H = Height of panel element.
D = Horizontal distance of panel element to right or left of normal from wall to feet of subject.

L	D Ft	SHAPE FACTORS						
		H—Ft						
		0	2	4	6	8	10	12
2 ft	2	0.108	0.211	0.230	0.094	0.020	0.005	0.002
	4	.068	.133	.145	.060	.012	.003	.001
	6	.048	.094	.103	.042	.009	.002	.001
	8	.037	.072	.079	.034	.007	.002	.001
	10	.030	.058	.064	.026	.006	.002	.001
	12	.025	.049	.054	.022	.005	.001	.001
4 ft	2	0.064	0.098	0.101	0.064	0.029	0.013	0.006
	4	.050	.077	.080	.051	.023	.010	.005
	6	.039	.061	.063	.040	.018	.008	.004
	8	.032	.049	.051	.033	.014	.006	.003
	10	.026	.041	.042	.027	.012	005	.002
	12	.022	.034	.036	.023	.010	.004	.002
6 ft	2	0.038	0.048	0.049	0.040	0.025	0.014	0.008
	4	.034	.042	.042	.035	.022	.012	.007
	6	.029	.036	.036	.030	.019	.010	.006
	8	.024	.031	.030	.026	.016	.009	.005
	10	.021	.026	.026	.022	.014	.007	.004
	12	.018	.023	.023	.019	.012	.007	.004
8 ft	2	0.024	0.026	0.025	0.025	0.019	0.013	0.009
	4	.022	.024	.023	.023	.018	.012	.008
	6	.019	.021	.021	.021	.016	.011	.007
	8	.017	.019	.018	.018	.014	.010	.006
	10	.015	.017	.016	.016	.012	.009	.006
	12	.014	.015	.014	.014	.011	.008	.005
10 ft	2	0.016	0.016	0.015	0.017	0.014	0.011	0.008
	4	.015	.015	.014	.016	.014	.011	.007
	6	.014	.014	.013	.014	.013	.010	.007
	8	.013	.013	.012	.013	.012	.009	.006
	10	.012	.011	.011	.012	.010	.008	.006
	12	.011	.010	.010	.011	.009	.007	.006
12 ft	2	0.011	0.011	0.011	0.012	0.011	0.009	0.007
	4	.011	.011	.011	.012	.011	.009	.007
	6	.010	.010	.010	.011	.010	.008	.007
	8	.010	.010	.010	.010	.010	.008	.006
	10	.009	.009	.009	.009	.009	.007	.006
	12	.008	.008	.008	.009	.008	.007	.005

Table 2—Shape Factors of Subject in Profile with Respect to Element of Wall Panel

L = Length of normal from wall to feet of subject.
H = Height of panel element.
D = Horizontal distance of panel element to right or left of normal from wall to feet of subject.

L	D Ft.	SHAPE FACTORS						
		H—Ft						
		0	2	4	6	8	10	12
2 ft	2	0.061	0.139	0.144	0.059	0.013	0.004	0.002
	4	.039	.088	.091	.037	.008	.002	.001
	6	.027	.062	.065	.026	.006	.002	.001
	8	.021	.049	.050	.020	.004	.001	.001
	10	.017	.039	.040	.016	.004	.001	.001
	12	.014	.032	.034	.014	.003	.001	.0004
4 ft	2	0.033	0.051	0.053	0.035	0.018	0.008	0.003
	4	.026	.041	.042	.028	.014	.006	.003
	6	.020	.032	.033	.022	.011	.005	.002
	8	.016	.026	.026	.018	.009	.004	.002
	10	.014	.021	.022	.015	.007	.003	.001
	12	.012	.018	.019	.013	.006	.003	.001
6 ft	2	0.020	0 025	0.026	0.022	0.016	0.009	0.005
	4	.018	.022	.022	.019	.014	.008	.004
	6	.015	.019	.019	.016	.012	.006	.004
	8	.013	.016	.016	.014	.010	.005	.003
	10	.011	.014	.014	.012	.009	.005	.003
	12	.010	.012	.012	.010	.007	.004	.002
8 ft	2	0.013	0.014	0.014	0.014	0.012	0.008	0.005
	4	.012	.013	.013	.012	.011	.007	.005
	6	.011	.012	.011	.011	.010	.006	.004
	8	.010	.010	.010	.010	.009	.006	.004
	10	.009	.009	.009	.009	.008	.005	.003
	12	.008	.008	.008	.008	.007	.004	.003
10 ft	2	0.009	0.010	0.010	0.011	0.009	0.006	0.004
	4	.008	.010	.009	.010	.008	.006	.004
	6	.008	.009	.008	.009	.008	.006	.004
	8	.007	.008	.008	.008	.007	.005	.004
	10	.006	.007	.007	.008	.006	.005	.003
	12	.006	.007	.006	.007	.006	.004	.003
12 ft	2	0.006	0.006	0.006	0.007	0.006	0.005	0.004
	4	.006	.006	.006	.006	.006	.005	.004
	6	.006	.006	.006	.006	.006	.005	.003
	8	.005	.005	.005	.006	.005	.004	.003
	10	.005	.005	.005	.005	.005	.004	.003
	12	.005	.005	.004	.005	.005	.004	.003



Figs. 12, 13, 14—Comparison of shape factor variation for the panel arrangements shown

ymmetrical pattern giving good enter line uniformity will usually ive even better uniformity along ny other parallel line to one side f the axis of symmetry.

Fig. 14, for an 8 ft ceiling, illus-ates the effect on uniformity of ne panel length for a design hav-g parallel line panels normal to, d with mid-points on, the ends f a center line of fixed length. urves A, B, and C, for 4 ft, 20 ft, d 40 ft line panels, respectively, ow that the center line variation arkedly improves (from 19 per nt to 9 per cent variation) as the ne panel progressively increases length. This means that a dis-ibution investigation based on a nveniently short (as 10 ft) line nel will give conservative results hen extended to a system involv-g greater length. For compari-n Curve X has been added to ow the variation for lines of zero length (point panels); it is noteworthy that the general shape of the distribution curve for end-spaced points is very similar to that for lines, the principal difference being that the end droops associated with points rapidly smooth out as line panels of increasing length are used. This close resemblance between line and point characteristics is of primary importance since it indicates a possibility of analyzing unknown panel patterns in terms of the simpler point analysis, then extending the results, conservatively, to the actual case of equivalent line panels.

Generalized Pattern for 8 *Ft Ceiling.* Figs. 15, 16, and 17 present the complete analysis leading to a determination of optimum pattern for ceiling panels in a room with 8-ft ceiling height. All data used in obtaining points for plotting the curves were obtained from the semi-profile curve of Fig. 2; the same data are available in more useful form (for this problem) as given in Fig. 11.

Curves A, B, and C of Fig. 15 are for point panels spaced at the ends of center lines of 8 ft, 10 ft, and 12 ft, respectively. To assist in visualization of the comparative differences in uniformity of these three patterns, the length of the abscissa in Fig. 15 has been held constant irrespective of center line length; thus points on the abscissa represent fixed percentages of the center line length, but do not correspond to the same absolute distance from one end of the center line. Curve A (8 ft spacing) shows excellent uniformity (10 per cent variation) for 75 per cent of the length of center line, marked departure occurring only in the region near the ends. Since the end region, for a panel-heated room, is that section of the room adjacent to the walls, it appears that non-uniformity in this vicinity is of much less significance than when it occurs near the center.

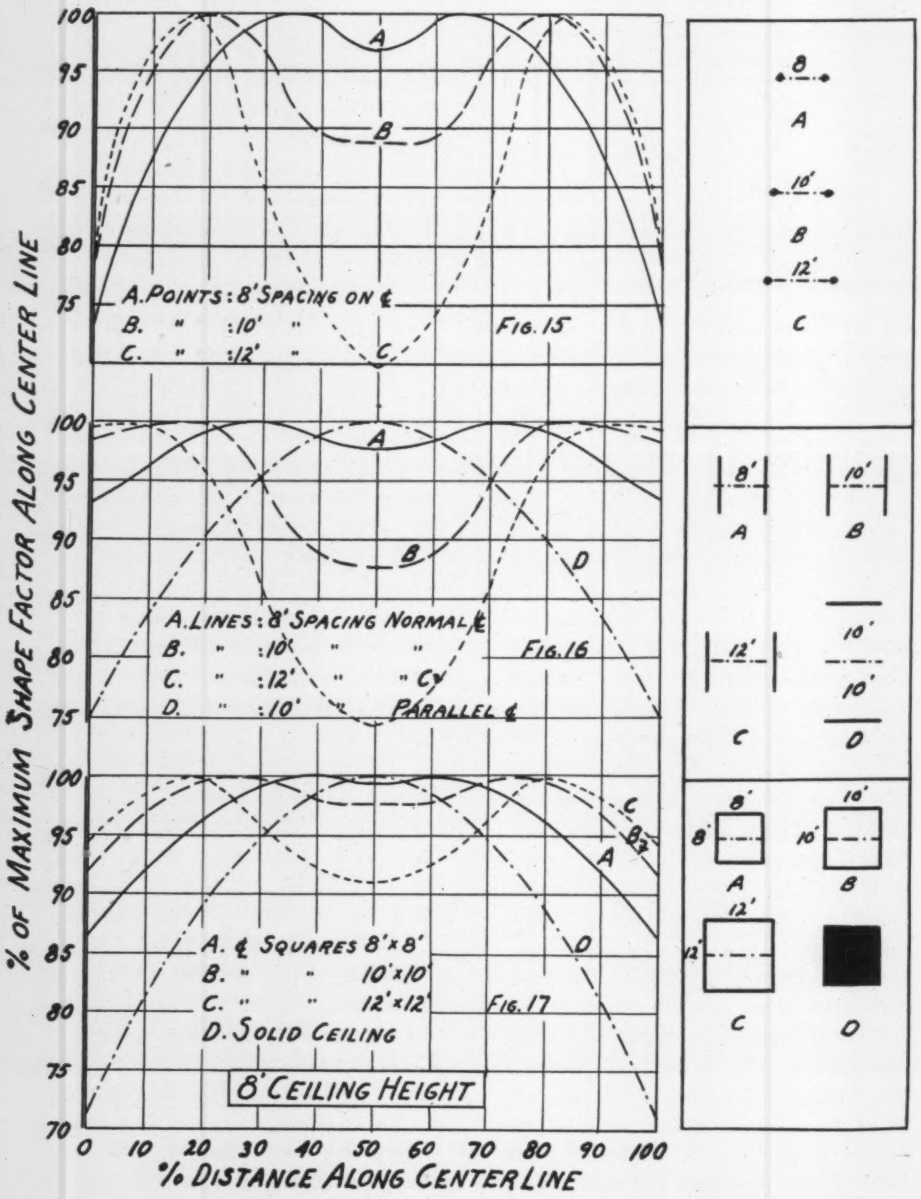
Increasing the spacing to 10 ft (Curve B) extends the region of satisfactory uniformity to 90 per cent of the center line length, but causes a falling off of the exchange rate through the central section. For 12 ft spacing the end condition is further improved, but the loss through the center has now increased seriously and unsatisfactory distribution exists in what would normally be the most important part of the room. The transition of the shape factor variation curve for these three spacings illustrates a condition which occurs at every ceiling height and one which provides a clue to the solution of the generalized distribution problem. Thus as spacing increases the shape of the curve varies from one with a pronounced peak at the center (the limiting case which evidently would occur for an 8-ft ceiling when the spacing is somewhat less than 7 ft) to one having a central sagging section with symmetrical peaks which move farther out as the spacing is increased.

The critical spacing responsible for the maximum central peak varies with ceiling height and is determined by the rate of increase of shape factor as a subject moves a short distance out from under unit panel. As spacing is reduced to the critical, the twin peaks of Curve A move closer together, coalescing at the critical spacing then crossing one another and moving out again as the spacing is further reduced. The limit for this second separation is obviously the condition of a single central point panel; for this case the variation would take the form of Curve B, Fig. 12. Separation of the panel to spacings greater than the critical, results in a continuous falling off of the exchange rate near the center. The limiting curve for this case is obviously similar in one-half form to that for a single point panel located at one end of the center line (Curve A, Fig. 12). Thus, for a room in which the smallest dimension exceeds that of the critical spacing for a particular ceiling height, the distribution problem reduces to one of determining that optimum spacing which is greater than the critical; for smaller rooms the optimum which must be sought is that for spacing less than critical.

Fig. 16 extends the point analysis of the preceding figure to line panels 10 ft in length. The principal difference in shape between the curves of Figs. 15 and 16 is the evident improvement in end characteristic which results from use of the line panels. With such panels the maximum variation is reduced to 12½ per cent for 10 ft spacing and 7 per cent for 8 ft spacing. Curve D of Fig. 16 gives the variation along a center line parallel to and midway between the line panels spaced 10 ft apart. This system presents a marked central peak which suggests that combinations of equally spaced pairs of 10 ft spaced orthogonal line panels would give supplementary variation curves which would superimpose to establish a reasonably uniform exchange rate throughout the heated space. The pronounced peak of Curve D, clearly indicates that, for two dimensional uniformity, the variation along the other orthogonal center line must have a sagging characteristic near the center. This requirement immediately suggests (comparing Curves A and B of Fig. 16) that 10 ft spacing would be more advantageous than 8 ft spacing. Such an assumption can be verified by plotting shape factor variation for the orthogonal systems.

Fig. 17 presents center line variation for squared panel patterns using orthogonal line panels a various spacings. Curves A, B and C, for 8 ft, 10 ft, and 12 f spacings, show the same trend i variation which was noted wit point spacing in Fig. 15, but th effect of the line panels parallel t the center line makes itself eviden in the reduced central sag (ove that of the corresponding curves i Fig. 16) and the more pronounce end sag. For purposes of comparison curve D is included; this curv is for a ceiling the entire surfac of which is heated and it emphasizes the fact that uniformity o direct radiant exchange is not realized with a solid ceiling panel.

Consideration of Fig. 17 leads t the conclusion that the optimu pattern for the panel center line in a room with 8 ft ceiling is i squares 10 ft on the side. Th conclusion is general and applies t rooms of any size. Howeve squared spacing on centers an where between the limits of 9 and 14 ft will give uniformity ha ing a maximum variation of le than 10 per cent and any such spa ing can therefore be used in pra tice without hazard of creating r gions in which the primary hea ing effect will be seriously out line. Thus, for a room 9 ft x 27 ceiling panels could be effective installed as a border around t edge of the room and with two cro panels of the same width as t border, thereby establishing—wi



Figs. 15, 16, 17—Determination of optimum pattern for ceiling panels in a room with 8 ft ceiling center lines — three 9 ft x 9 ft squares. There will be, of course, an alteration of the basic square variation as shown in Fig. 17, due to outlying sections of panel, but this effect, for squares greater than 9 ft on the side, can be readily shown to cause no serious alteration of the basic curves.

Generalized Pattern for 10 Ft Ceiling Height. The procedure for determination of optimum panel distribution for a 10 ft ceiling height is essentially the same as that outlined in section C, above, and is shown in Figs. 19, 20, and 21. Fig. 18 shows, in Curves A, B, C, and D, respectively, the change in distribution as point spacing on a 10 ft center line is increased from 1 ft (equivalent to a line panel) to 5 ft, 8 ft, and finally to points located at ends of the 10 ft line; the critical spacing for this ceiling height evidently occurs at 8 ft since a sharp single peak is then found and twin peaks result due to a shifting of the point panels in either direction (to 5 ft or to 10 ft) from this critical value.

Fig. 19 shows the effect of altering the spacing of point panels from 8 ft to 10 ft, 12 ft and 14 ft. From the discussion in section C it would appear that the end droop could be ignored in evaluating the relative merits of the spacings shown and that the significant region of the curves is that near mid-point of the center line. The 8 ft spacing is obviously unsatisfactory and consideration of the peak expected from the orthogonal panels which will lie parallel to the center line suggests that a spacing giving a moderate central sag as for 12 ft and possibly 14 ft, would be most likely to result in optimum squared spacing.

Fig. 20 gives the line panel pattern for 10 ft, 12 ft, and 14 ft spacing with an added curve, X, to show the distribution for 14 ft line panels parallel to and 7 ft on either side of the center line. The peak of Curve X indicates clearly that 14 ft spacing for a squared pattern, is probably close to the optimum. This is substantiated by the curves of Fig. 21 which show that the extended peaks, and slightly sagging central section characteristics, of 14 ft squared spacing gives a deviation of less than 5 per cent for over 70 per cent of the

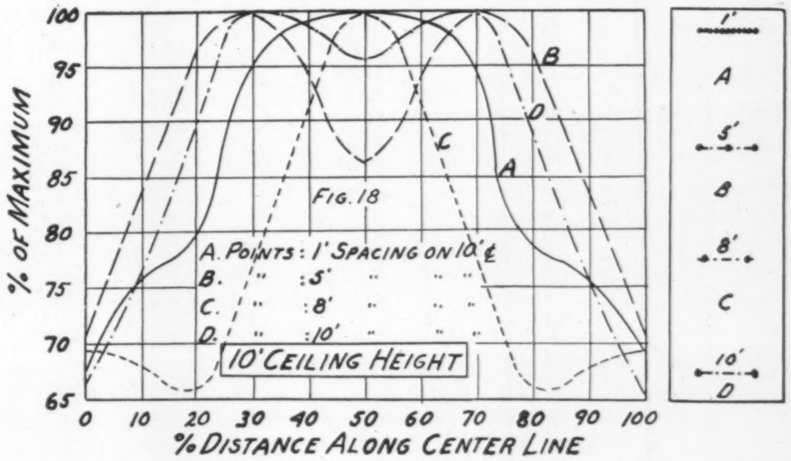


Fig. 18—Change of distribution as point spacing is increased

center line. Ten-foot spacing is more uniform near the center, but falls off more rapidly at the edges, while a solidly heated ceiling gives poor distribution.

The conclusion for this ceiling height is that a 14 ft spaced square center line panel distribution will give best possible uniformity of direct heating effect. Squared patterns with spacings in the range from 10 ft to 15 ft will provide a degree of uniformity adequate for most installations, but use of a solid ceiling panel would seriously affect the uniformity of exchange for average size rooms.

Generalized Pattern for 12 Ft Ceiling Height. Fig. 22 groups curves showing the effect of point spacing for a 12 ft ceiling height and a 10 ft center line. The curves for this case are of special interest because the critical spacing occurs at a distance, 10 ft, which frequently is significant as a room dimension. Thus, 10-ft spacing should not be used in a room 12 ft in height and the problem for this case requires investigation of spacings on both sides of the critical value. Fortunately, as is evident in Fig. 22, the optimum spacing short of the critical occurs at a value (2 ft) so close to that for a line panel that one would expect a solidly heated ceiling to give satisfactory uniformity when used in rooms having a major dimension less than about 14 ft. This case is unusual in that it is the only one, of those investigated, for which a solid ceiling gives satisfactory uniformity of direct radiant exchange.

Figs. 23, 24, and 25 give the variation for point, line, and squared center line distribution of panels in a space with 12 ft ceiling. Fig. 23 shows that surprisingly good uniformity is realized when 18 ft spacing is used and that the customary center section sag effect evidently does not commence until the spacing reaches approximately 20 ft; for 22 ft spacing the sag is sufficient to indicate serious departure (16 per cent) from uniformity of direct radiant exchange. Consideration of these curves in terms of the discussions of sections C and D, above, leads to the conclusion that a squared line panel pattern with spacing of 20 ft (acceptable range from 17 ft to 21 ft) will give excellent energy distribution in any room having a 12 ft ceiling; likewise, the same considerations indicate that, for this ceiling height, spacings between 8 ft and 15 ft should be avoided.

When the room to be heated is less than 14 ft in length or width, some pattern other than that recommended above must be resorted to. To assist in solving this problem, Figs. 24 and 25 have been constructed. Fig. 24 shows variation along a 10 ft center line resulting from 2 ft, 5 ft, and 10 ft spacing of 10 ft line panels and from a similar line panel either normal to the center line at its mid-point or parallel to it and directly overhead. The good distribution resulting from 2 ft spacing suggests that a solidly heated ceiling would provide acceptable uniformity for a room less than 14 ft on a side while the compensating non-uniformities of the centrally located 10 ft line panels indicate the possibility of obtaining satisfactory uniformity by installing the panels as axial strips forming a cross with center at the mid-point of the room.

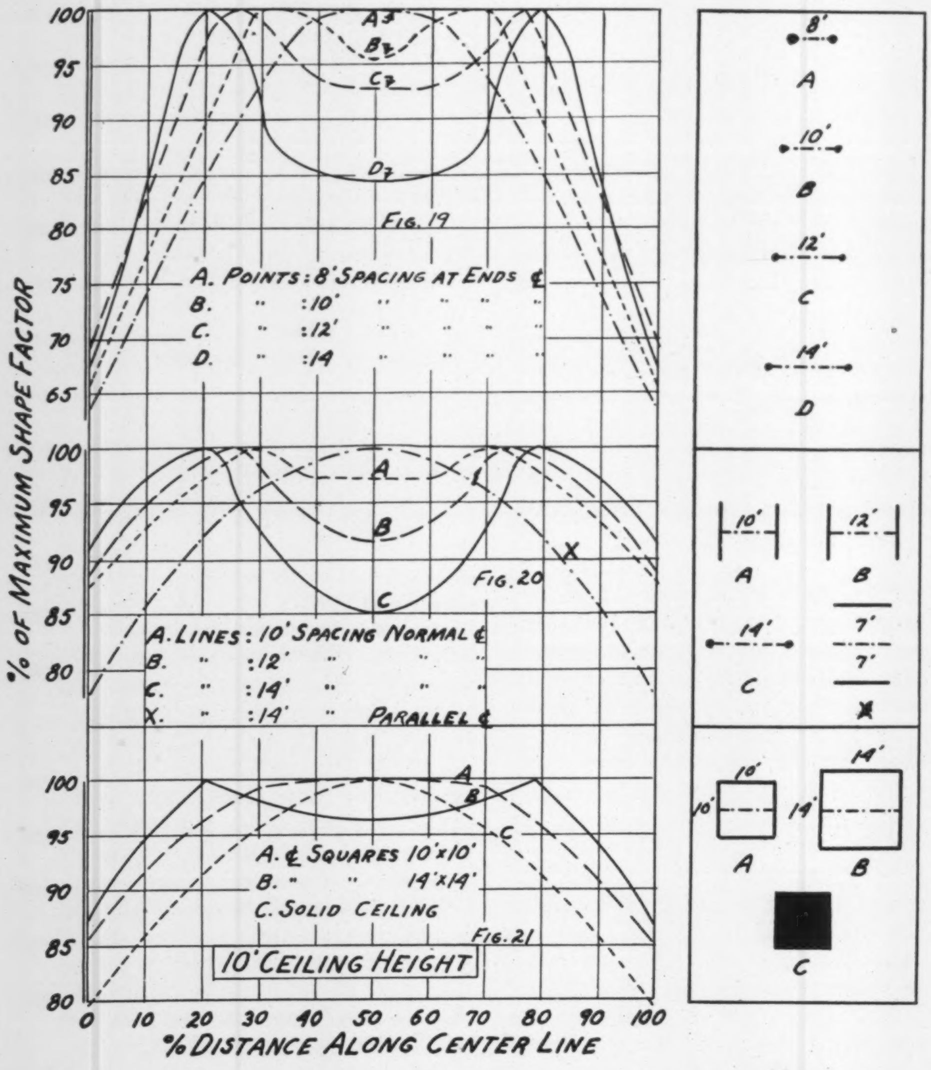
Both of the arrangements discussed herein are represented in Fig. 25. From this figure it appears that the cross pattern is the more effective and should be used in preference to a solidly heated ceiling or to a solid panel located at the center of the room. However, the uniformity realized with a completely heated ceiling is satisfactory (13 per cent variation) and can be used, when heating load makes such a large area desirable, without unsatisfactory effects for rooms of any size.

The general conclusions for rooms of 12 ft height are, therefore, that complete coverage of the ceiling is acceptable for rooms of all sizes but that a square center line pattern with 20 ft spacing is the preferred arrangement for large rooms while crossed panels on the two room axes give best uniformity for small (as 10 ft x 10 ft) rooms.

Limitations and Generalized Distribution Patterns. The primary advantage of the generalized distribution patterns as determined in preceding sections is in the savings in time which use of such standard panel arrangements permits over that needed to evaluate the variation in uniformity of heating effect due to use of an arbitrarily selected pattern for each room considered. Generalized patterns provide a simple and convenient method of laying out center lines for a panel distribution for which satisfactory uniformity is assured; from this basic starting point the designer will in many cases alter the pattern to meet special room conditions, yet not allow the over-all arrangement to depart so widely from the fundamental pattern as to risk serious non-uniformity.

As with any other generalized solution of an engineering problem, the assumptions and special conditions underlying the standard patterns must be kept in mind and corrections or alterations applied for rooms in which unusual factors, or wide variability of the common factors, appear. Thus, use of highly reflective wall or floor surfaces (reflective, that is, to radiant energy of wave length in the infrared section of spectroradiometric curve) would greatly increase the fraction of energy reaching the subject from the panel (after one or more intermediate wall or floor reflections) and would therefore reduce and possibly obliterate the significance of variations in primary transfer. Fortunately, however, interreflections usually serve to increase uniformity so that use of the standard patterns would, in this case, be expected to lead to a conservative result.

Other special conditions, as use of a panel with spectral transmission characteristics, may lead to a complete invalidation of the variation curves constructed from the basic experimental data. Likewise, other conditions within the heated space, as extreme localized exposures on one or more walls, may lead to secondary exchange characteristics which can be of much greater significance than the primary interchange by direct transfer between subject and panel; in such cases an effective distribution of panel surface can only be obtained if consideration is given to the relative magnitude of direct and indirect components of the irradiation experienced by the subject. As an example, consider a square room with inside partitions on three sides and a large window located in an exposed wall on the fourth side. For such a case some compensation is obviously required for the direct radiant heat loss from occupant to the low temperature window and wall surface; this can be obtained by reducing the average width of panel along all center lines of the pattern except that one which is located parallel to and in the vicinity of the exposed wall. The amount of panel surface to be shifted to a center



Figs. 19, 20, 21—Determination of optimum pattern for ceiling panels in a room with 10 ft ceiling line near the wall, for this case, will depend on radiant loss from subject to window and to wall; thus a careful analysis would require study of the room uniformity characteristics for the individual case. In practice such individual attention to the exigencies of each particular room can not be justified, but a reasonably accurate approximation can usually be obtained by using judgment and experience as guides in estimating the extent of distortion of the standard pattern which will be required to compensate for the room's peculiarity. Note that in all such cases the effect of localized secondary heating or cooling surfaces influences only the distribution and not the total area of panel.

Deviations from the uniformity curves for standard patterns will also occur whenever the panel width is large with respect to the center line spacing of a squared pattern. This situation must inevitably arise whenever the heat transfer characteristics of the room are such that a large fraction of the ceiling area must be heated. No correction for this condition is possible (unless a higher temperature panel can be used as a means of reducing total required area), but the standard patterns are still of value since they give an exchange variation at least as good as any which can be obtained within the limitations of required total surface area.

Inadequacy of generalized patterns for use in rooms subject to special occupancy conditions: In a hospital room, for example, the heating surface could effectively be located to provide the desired effect at the location of the bed and without respect to uniformity along the axes of the room. Likewise, in factory rooms where occupants retain fixed positions, or in theaters, classrooms, and auditoriums, where the design is based on a seated subject, the generalized distribution systems developed in this paper (for a standing subject) will either be invalid or in need of adjustment. In all such cases, optimum distribution arrangements can be obtained by application and analysis of the basic experimental data presented in Figs. 2 through 10. By the same method used in obtaining the generalized pattern, for a standing figure, similar optimum arrangements can be deduced for a seated figure. Examination of the basic data for wall panels will also show that some of it can be extracted and re-tabulated or re-plotted to give the shape factors of a prone subject with respect to points on ceiling panels.

The most common reason for departing from optimum patterns in rooms where these do apply is because of the saving in first cost which is frequently to be realized by use of a simpler distribution. Study of the increased percentage deviation resulting from departure from standard patterns will show that the saving is in many cases obtainable without serious sacrifice in uniformity. In all such cases generalized pattern can be effectively used as a guide for estimating the best method of adjusting panel shape to obtain minimum loss of uniformity, yet retain an economically feasible simplicity in arrangement of both the panels and the connecting energy source (as piping, wiring, etc.).

Summary

Basic experimental data has been presented to permit direct determination of fraction of energy received by a seated or standing subject from a wall or ceiling panel of elementary area. From those data information is also obtainable as to the fraction of energy received by a prone subject from an elementary ceiling panel. All experimental determinations are in groups of three based on the position of the subject with respect to the source both as to vertical and horizontal components and for full face, semi-profile and profile atti-

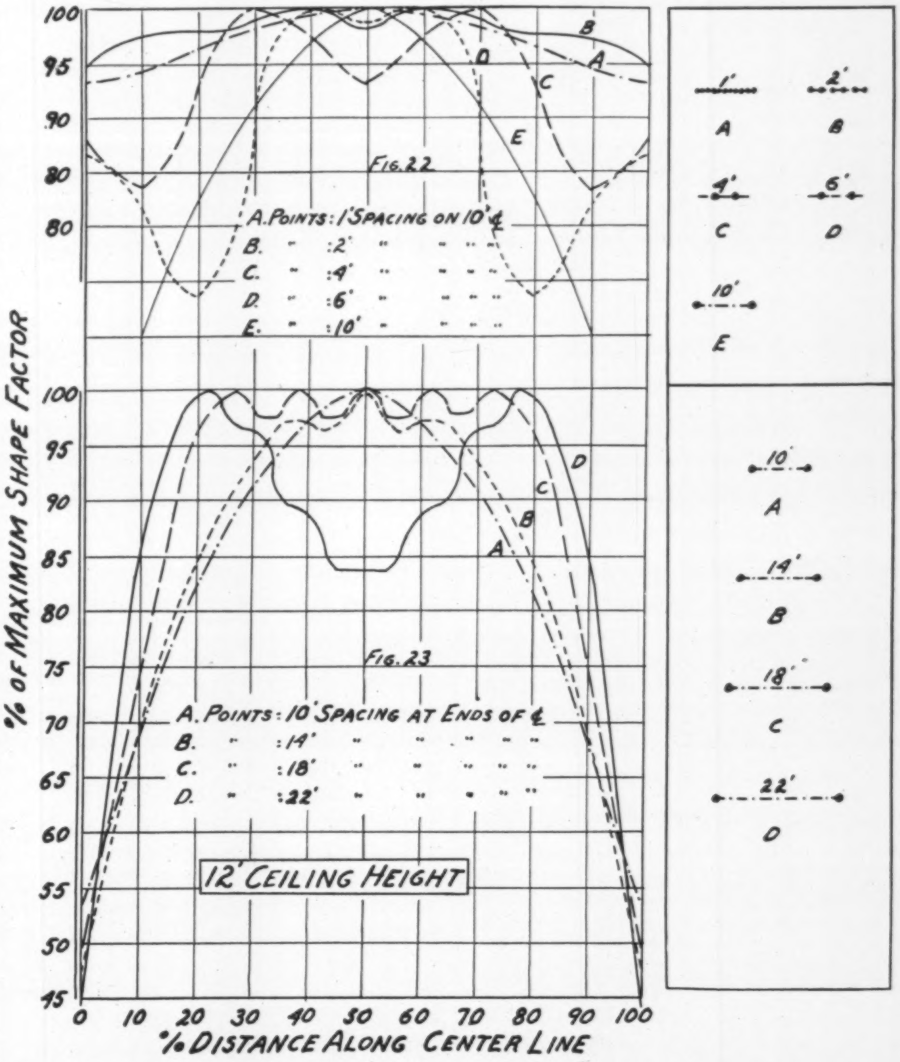


Fig. 22—Effect of point spacing for a 12 ft ceiling height and a 10 ft center line
Fig. 23—Variations with point spacings on 12 ft ceiling

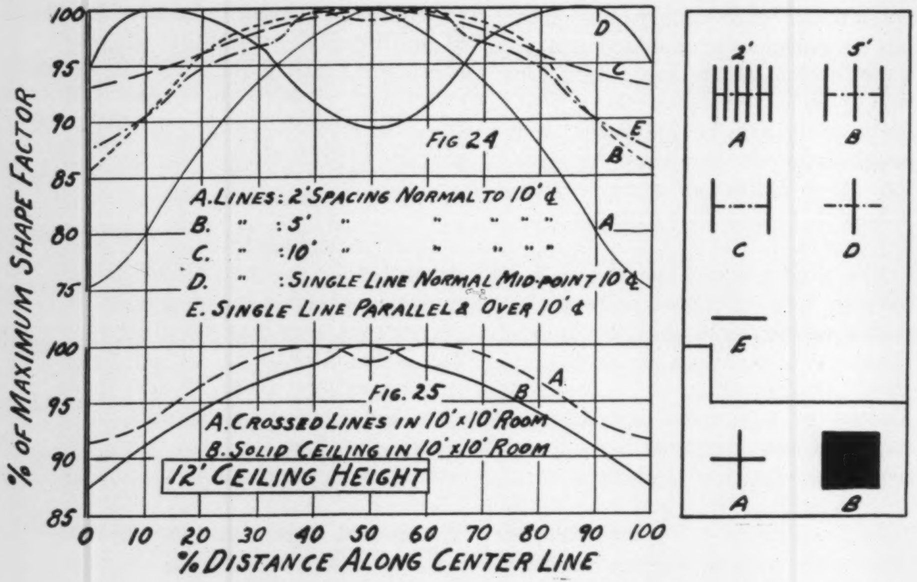


Fig. 24—Variations with center line spacings
Fig. 25—Variations with crossed center lines and solid ceiling panel

tudes.

Use of the basic data to compute the absolute shape factor of a subject in any position with respect to a panel of any shape and size is described and illustrated; for panels of usual size in rooms having a ceiling height between 8 ft and 12 ft the order of magnitude of the shape factor is 1—2 per cent; that is, less than two per cent of the energy radiated from a conventional panel passes directly to the occupant.

Generalized patterns for the center lines of ceiling panels have been determined for the standing subject in semi-profile position. The recommended patterns are:

1. For 8 ft ceiling height use a square pattern with center lines spaced at 10 ft for best results; wherever possible spacings outside of the range from 9 ft to 14 ft should be avoided; the use of a single block panel in the center of the room is not recommended.
2. For 10 ft ceiling height a square pattern similar to that described above is recommended, but with 14 ft spacing as the optimum and 10 ft to 15 ft as the limiting range.
3. For 12 ft ceiling a square pattern with 20 ft optimum spacing is recommended (range 17 ft to 21 ft). For rooms smaller than 14 ft x 14 ft a pattern consisting of centrally located crossing panels running along both axes of the room is satisfactory. Unlike rooms having 8 ft or 10 ft ceilings, a 12 ft ceiling room does have satisfactory uniformity of direct radiant exchange when the entire ceiling is used as a panel.

Limitations of the generalized patterns are discussed and the suggestion offered that the proposed standard panel distributions be used as an initial design arrangement from which to depart in seeking greater simplification, adjustment for localized exposure, or corrections for such diverse effects as inter-reflections, non-diffuse emission and the many other factors which preclude use of any completely generalized solution for optimum design of all installations.

Fundamentally, the purpose of this paper has been to present the basic experimental data which have been obtained in completion of one part of the research program being conducted at the University of California in cooperation with the American Society of Heating and Ventilating Engineers. The analytical sections of the report and the recommendations concerning use of standard panel arrangements are intended primarily as tentative suggestions pending more complete analysis of the basic data. In all probability more effective and possibly less complex patterns can be developed; with the necessary experimental data now complete, search for such improvements can be readily carried on by anyone who cares to devote the necessary time to the rather tedious task of analyzing the data.

Acknowledgments

The greater part of the laboratory work on this unit of the panel research project was performed by Messrs. Harold Thomas, E. H. Attix, W. R. Wykoff, Philip Ashworth, and Charles Dischler.

Appendix

The Stefan-Boltzman law gives the rate of radiant energy emission from a surface of uniform temperature and emissivity as

$$dq/dA = \sigma \, e \, T^4 \quad \ldots\ldots\ldots (1)$$

where: dq/dA = Btu/(hour) (sq foot of emitting surface)
σ = Stefan-Boltzman constant
$= 0.172 \times 10^{-8}$
e = emissivity of the emitter
T = temperature, degree Fahrenheit absolute

For a perfectly diffuse source the rate of emission in a given direction, per unit area projected on a plane normal to that direction, is independent of the direction (as measured by angle ϕ from a normal to the emitting surface) and is related to the total emission by the equation,

$$dq/dA = I\pi$$

The irradiation rate at an infinitesimal surface dA_2 due to energy emitted by surface dA_1 is then

$$(dq/dA_1)_{1\rightarrow 2} = I \, \pi \, (\cos \phi_1 \, dA_1) \left(\frac{\cos \phi_2 \, dA_2}{r^2} \right)$$

where $(\cos \phi_1 \, dA_1)$ = projected area of dA_1 on plane normal to direction of emission

$\left(\frac{\cos \phi_2 \, dA_2}{r^2} \right)$ = element of solid angle through which energy leaving dA_1 passes to dA_2

r = distance between mid-points of dA_1 and dA_2

$\phi_1 \phi_2$ = angles between direction of r and respective normals to surfaces dA_1 and dA_2

Re-writing the above equation in more convenient form and integrating over both surfaces,

$$(dq/dA)_{1\rightarrow 2} = \sigma \, e_1 \, T_1^4 \, A_1 \left[\frac{1}{\pi} \int_{A_1} \int_{A_2} \left(\frac{\cos \phi_1 \cos \phi_2 \, dA_1 \, dA_2}{r^2} \right) \right] . \quad (2)$$

Comparison of Equations 1 and 2 shows that they differ by the bracketed term of 2. This term is a function only of the geometry of the system and is therefore called the shape factor; thus, the shape factor is numerically equal to the fraction of energy striking surface A_2 of that emitted by A_1.

Nominees for Members of Council

(Three-Year Term)

Carlyle M. Ashley was born at Indianapolis, Ind., August 17, 1899, and following his early schooling attended Central High School, Washington, D. C.

While doing high school post-graduate work at Buffalo, N. Y., he became associated with Carrier Engineering Corp., doing part-time work as test and computation assistant. He completed his college training at Cornell University, graduating in 1924 with a degree in mechanical engineering. After his graduation he was employed by Carrier Engineering Corp. as engineer in Research Engineering, Standard Products and Research and Development Departments, and in 1931 he became engineer in charge of Technical Design for the Carrier Research Corp., and in 1933, Director of Research. In 1936 he became Director of Development for Carrier Corp., which position he now holds.

C. M. Ashley
Syracuse, N. Y.

Mr. Ashley has served on many Society Committees since he joined the Society in 1931. He was a member of the Research Technical Advisory Committee on Sound in Relation to Heating and Ventilation from 1931-1936; a member of the Committee on Cooling Load in Summer Air Conditioning from 1937-1942, serving as its chairman the last three years; he also served as a member of the Technical Advisory Committee on Sound Control from 1937-1942; as a member of the Committee on Air Conditioning Requirements of Glass in 1940-1941 and 1942.

In 1941 he was elected for a three-year term on the Committee on Research. He was a member of the Technical Advisory Committee on Heat Transfer Through Finned Tubes in 1941-1942, and was appointed a member of the Executive Committee of the Committee on Research and is Chairman of the Committee on Research, and also a member of the present Executive Committee.

Mr. Ashley is also a member of the ASRE and has served on many of its technical and industrial committees.

⁂

Lester Tryon Avery, President of Avery Engineering Co., Cleveland, Ohio, was born in Painesville, Ohio, August 28, 1896, and after attending Shaw High School entered Case School of Applied Science, from which he received his B.S. degree in 1918.

For three years he was refrigeration engineer for The Hibbard Co., Cleveland, and in 1921 he became district manager for the American Carbonic Machinery Co., where his duties covered designing, selling and supervising the installation of commercial refrigeration and air conditioning systems, and in 1928 was placed in charge of the Chicago office. He remained there until 1929, when he became president of Avery Engineering Co.

He joined the ASHVE in 1934, immediately taking an active part in the affairs of the Northern Ohio Chapter. He served as its President in 1936-37, and as a member of the Board of Governors in 1937-38. He also served as a member of the Program, Standards, Nominating and Convention Committees of the Chapter. In 1939 he served as a member of the Finance Committee of the Committee on Research, and was a member of the Research Technical Advisory Committee on Air Conditioning Requirements of Glass from 1940 to date. In 1942 he served as a member of the Committee on Constitution and By-Laws and is now chairman of the present committee. In 1942 he also served as a member of the Technical Advisory Committee on Air Conditioning in Industry, and is serving on the current committee. He is a member of the Committee of 100 for Cleveland Committee for Economic Development (C. E. D.).

Mr. Avery is the author of a number of technical articles published in various trade publications, including Heating, Piping & Air Conditioning, Heating & Ventilating, Refrigerating Engineering, etc.

L. T. Avery
Cleveland, Ohio

He is also a member of the Case Alumni Council, American Society of Refrigerating Engineers, and in Cleveland he belongs to the Cleveland Engineering Society, the Rotary, Athletic and Hermit Clubs, Cleveland Chamber of Commerce, and the Beta Theta Pi Fraternity.

⁂

Lauren E. Seeley, associate professor of mechanical engineering, Yale University, New Haven, Conn., was born in Meriden, Conn., November 8, 1898. He received his Ph.B. in 1921, his M.E. in 1924 from Yale University, and in 1935 received a degree of LL.B. also from Yale.

In 1921 he did graduate work, including investigations on hot blast heaters, thesis on smokeless combustion of high-volatile fuels, and development work on high pressure automotive boilers. From 1923 to 1928 he taught mechanical engineering, including the testing of experimental boiler designs, consulting work on heating equipment, oil burner tests, study of artificial

L. E. Seeley
New Haven, Conn.

fuels, radiator tests, radiation loss from boilers, and from 1924 to 1931 he spent four summers in industry relative to boiler tests, design, catalog, laboratory procedure and organization. In 1925 he was put in charge of the course in heating and ventilation at Yale, which he continues to date.

Professor Seeley joined the Society in 1930 and has taken an active interest in both Society affairs and in the local Chapter's affairs, having served as president of the Connecticut Chapter for the 1940-41 season, and as a member of its Board of Governors from 1941 to date. Prior to joining the Society he served as a member of the Committee on Rating Low-Pressure Boilers in 1927; in 1928 he was a member of the Committee on Rating and Selection of Low-Pressure Boilers; and also a member of the Committee on Maximum Boiler Output; in 1929 and 1931 he served as Chairman of the Committee on Oil Burning Devices, and as a member of this committee in 1930-32-33; he was a member of the Research Technical Advisory Committee on Solid Fuels in 1940, a member of the Local Chapter's Committee in 1941 and 1942, as well as being Chairman that year of the Joint Committee on Standards for Residence Heating. In 1943 he was appointed a member of the Society's Publication Committee to serve for a three-year term. He is also a member of the War Service Committee of the Society and the Research Committee.

Professor Seeley is a member of Sigma Xi, Yale Chapter, serving as treasurer and vice-president. He is also a member of the Connecticut Forest and Park Association, Marketing Commission, has served as treasurer and chairman of the New Haven Section of ASME, he is a member of the Society for Promotion of Engineering Education, Yale Engineering Association, and is a member of the Northeast Wood Utilization Council.

He served as a member of the armed forces in World War I, and has served as regional adviser on engineering, science, management War Training Program for Connecticut and Rhode Island from 1941 to date under the United States Office of Education. He was also appointed a member of the Connecticut Commission on Conservation of Manpower in 1942 and is still acting in that capacity. He is also a member of the present Regional Training Committee of War Manpower Commission. He served as a member of the Regional Labor Supply Commission of New England in 1941-42. He was special consultant for OPA in 1942, chairman of Advisory Committee on Industrial Training, and chairman of the Manufacturing Committee of the Connecticut War Council.

⁂

Glen D. Winans, engineer of steam distribution, The Detroit Edison Co., Detroit, Mich., was born at Plymouth, Mich., on September 19, 1895, where he received his elementary education. He received his B.S. in mechanical engineering in 1921 from Ohio Northern University, Ada, Ohio.

He became a member of the Society in 1928, and became active in the affairs of the Michigan Chapter, serving as its Secretary from 1931 to 1933, as Vice-President from 1933-1934, and President from 1934-1935, and as a member of the Board of Governors in 1935 and 1936.

Mr. Winans has published articles in the NDHA Proceedings 1936, is the co-author of Underground Piping for District Heating, published in Heating, Piping & Air Conditioning, May 1930, wrote Chapter 3 of the NDHA Handbook, and is revising the Chapter on District Heating for the current edition of The Guide.

G. D. Winans
Detroit, Mich.

Mr. Winans served as President of the National District Heating Association in 1939-1940. He is a registered Professional Engineer and holds membership in the Engineering Society of Detroit, as well as being a member of the American Legion.

TWO LIFE MEMBERS HONORED

Among the seven men who were awarded certificates as charter members of the Society for the Promotion of Engineering Education were two Life Members of the ASHVE: Dr. F. E. Giesecke, College Station, Tex., past president of the ASHVE, and D. S. Jacobus, Montclair, N. J. The other charter members who received their certificates of life membership were: C. F. Allen, M. E. Cooley, D. C. Jackson, L. E. Reber, and R. L. Sackett.

Dr. Giesecke, now Professor Emeritus of Heating and Air Conditioning Engineering at Texas A. and M. College, was born in Washington County, Tex., in 1869. He was graduated from Texas A. and M. in 1890, and after studying abroad received degrees from M.I.T. and the University of Illinois. He is the author of several technical books, on mechanical drawing and hot water heating. In 1942 he received the F. Paul Anderson Gold Medal awarded by the ASHVE for distinguished scientific achievement, based on his research work in the fields of heat transfer and hot water heating.

Dr. Jacobus, now retired, after being associated with Babcock and Wilcox for over 35 years, was born at Ridgefield, N. J., in 1862. He received his early education at a private school, later attending Stevens High School, and in 1884 received his degree in mechanical engineering from Stevens Institute of Technology.

Stevens Institute conferred on him the honorary degree of Doctor of Engineering. He is also a member of AIME, AIEE, ASME, and ASRE.

SUMMARY OF LOCAL CHAPTER MEETINGS

Chapter	Meeting Date	Subject	Speakers	Other Features	Attendance	Attendance Ratio*
New York	Oct. 18	The Society's Activities in Wartime, Its Part Taken in the National Fuel Conservation Program The Branches of National Society, Its Membership, Its Healthy Financial Position, Its Research Facilities and Program Introduced the New Director of Research, Cyril Tasker, Member of the Ontario Chapter	Pres. M. F. Blankin, Philadelphia, Pa.	Program Committee Chairman M. C. Giannini Outlined a Splendid Setup for 1943-44 Season General Chairman for National Convention Alfred J. Offner Outlined a Feature for Convention. Project in charge of C. F. Roth Membership Chairman H. J. Ryan Urged Members to Encourage Others to Join and Submit the Names to His Committee	57	0.35
Illinois	Oct. 11	Package Heat—Present and Future Possibilities	Dave Jones, Engr., Vapor Car Heating Co.	Reports of Officers and Committees	84	0.58
Pittsburgh	Oct. 11	Panel Heating	C. W. Hawk, Jr., A. M. Byers Co., Engineering Service Dept.	Regular Business Meeting	38	0.59
St. Louis	Oct. 8	Evaporative Cooling in War Production	Charles N. Deverall, Engineering Dept., Niagara Blower Co.	None	40	0.65
Ontario	Sept. 27	Opening Meeting—Coal Conservation	N. W. Kingsland, Dir. of Coal Conservation, Office of Coal Controller	Presentation to Cyril Tasker by Ontario Chapter	86	0.75
		Fuel Oil	A. S. Morgan, Oil Controllers Office			
Minnesota	Sept. 13	The Pertinent Facts About the War and People of Europe	George C. Jordan, editorial writer, Minneapolis Star Journal	A. W. Schultz's resignation accepted	30	0.32
St. Louis	Sept. 7	Trends in the Heating and Ventilating Industry	Prof. W. T. Miller, Chief Instructor, Heating and Ventilating, Purdue University, Lafayette, Ind.		34	0.56
North Carolina	Aug. 27	Electronics, the New Science	Edwin S. Lammers, Westinghouse Electric Mfg. Co.		200	4.81
		Post War Prospects in Chemistry	Capt. Joseph LeConte, Chemical Warfare Service			
		North Carolina Minerals in the Post War Period	Dr. J. L. Stuckey, State Geologist			
		Banquet — Post War Planning discussed	Robert M. Hanes, Pres., Wachovia Bank and Trust Co.	Arvin Page, toastmaster		

---

*The attendance ratios shown represent the meeting attendance divided by the Chapter membership. These will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by other local chapters and may be helpful in deciding on subjects for other chapter meetings.

Indiana Chapter Receives Charter

S. E. Fenstermaker
President

W. C. Bevington
Vice-President

L. W. Clark
Treasurer

C. W. Stewart
Secretary

Board of Governors

C. H. Hagedon

G. B. Supple

On November 1 the Indiana Chapter of the Society received its Charter from Pres. M. F. Blankin at a dinner meeting at the Columbia Club, Indianapolis.

The officers of the newly organized chapter who were installed in the presence of members of the Council of the Society are: *President* — S. E. Fenstermaker; *Vice-President*—W. C. Bevington; *Secretary*—C. W. Stewart; *Treasurer*—L. W. Clark; *Board of Governors*—C. H. Hagedon, Prof. W. T. Miller, and G. B. Supple.

The speaker of the evening, Dr. B. M. Woods, Director of the University Extension, University of California, Berkeley, Calif., spoke on How to Plan for the Future of Air Conditioning. In his talk he discussed some of the postwar problems of the profession and explained the role of the engineer in solving the problems that will develop in meeting the public demand for heating and ventilating and air conditioning of the future.

He stated there has been wide public acceptance of air conditioning all over this country; engineers today know how to build successful equipment and the Society has sponsored research to establish that elusive condition called comfort.

The next few years will see the perfection of better functioning equipment to achieve conditions of optimum comfort. Planning must go forward now to prepare for the demands which will follow victory. People will not be satisfied with the old model in a new age.

Members of the Council with other visitors were introduced by President Fenstermaker, who also acknowledged receipt of many messages of greeting and good wishes for the success of the Chapter from other Chapters in the Society.

Prior to the Chapter Meeting, a meeting of the Council was held and those in attendance were: M. F. Blankin, President; S. H. Downs, Vice-President; C.-E. A. Winslow, Vice-President; E. K. Campbell, Treasurer; C. M. Ashley, Chairman, Committee on Research; E. N. McDonnell, J. F. Collins, Jr., Comdr. Thos. H. Urdahl, L. G. Miller, A. J. Offner, W. A. Russell, L. P. Saunders, Dr. B. M. Woods, C. Tasker, Director of Research and A. V. Hutchinson, Secretary.

FAHNESTOCK IN NEW POST

Announcement has been made of the appointment of M. K. Fahnestock, University of Illinois, Urbana, Ill., to Research Professor of Mechanical Engineering and Assistant Director of the Engineering Experiment Station, effective September 1, 1943.

Professor Fahnestock will maintain contacts in the heating, ventilating and air conditioning fields, both in the physical and biological sciences. He will continue to coordinate the research work in the University's Colleges in Chicago and Urbana, which relate to the effect of atmospheric environment on humans, both normal and impaired. It is expected that this work will be greatly extended at the close of the war. He is also interested and engaged in helping in the development of the University's new program of Education and Research in Air Transportation.

WILHELM PRESIDENT CLEVELAND SECTION ASRE

Joseph E. Wilhelm, chief engineer with the Avery Engineering Co., Cleveland, Ohio, has been elected chairman of the Cleveland Section American Society of Refrigerating Engineers for the 1943-44 season. The Cleveland Section has a membership of 100 engineers and executives interested in the refrigerating industry. Meetings are held at the Cleveland

Engineering Society Club Rooms on the third Tuesday of each month.

MANITOBA PRESIDENT IN SERVICE

A meeting was held by members of the Manitoba Chapter of the Society in honor of Ivan McDonald, who left July 3 on active service as Lieutenant with the Winnipeg Grenadiers.

Mr. McDonald, who has been the representative of the Minneapolis-Honeywell Regulator Co. in Winnipeg for the past eight years, is the retiring President of the Manitoba Chapter for the 1942-43 season. This July 2 meeting in his honor was attended by H. Evans of the Minneapolis-Honeywell head office, and by many of his friends in the local Chapter, who presented Mr. McDonald with a leather toilet kit, together with their best wishes.

Ivan McDonald

R. M. GATES HEADS ASME

Robert M. Gates, president of the Air Preheater Corporation, New York, an authority on steam generation and industrial management, has been elected president of the American Society of Mechanical Engineers, it was announced September 28 at headquarters of the Society, 29 West 39th St., after tabulation of a letter ballot of the ASME membership. He succeeds Harold V. Coes of New York.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the Journal of the Society or sent to the members in other approved manner as ordered by the Council. When replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 38 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by November 15, 1943, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

CANDIDATES	REFERENCES	
	Proposers	*Seconders*
ALEXANDER, HUGH V., Branch Mgr., Johnson Service Co., Indianapolis, Ind.	G. B. Supple W. C. Bevington	T. R. Davis S. E. Fenstermaker
APPERT, RICHARD J., Product Engr., Kimberly-Clark Corp., Neenah, Wis.	R. M. Eiss A. D. Appert	*J. A. Foley *R. B. Sawtell
BARKER, M. S., Engr., Carrier Corp., Syracuse, N. Y.	Americo Silvers W. H. Carrier	Margaret Ingels N. E. Sheldon
BARTON, FRED C., Supervisory Mech. Engr., Allison Engineering Co., Indianapolis, Ind.	G. B. Supple R. D. Tutt	W. C. Bevington S. E. Fenstermaker
BOONE, FRED S., Sec'y-Treas., Hall-Neal Furnace Co., Indianapolis, Ind.	G. A. Voorhees S. E. Fenstermaker	C. H. Hagedon W. C. Bevington
BUSENLENER, LOUIS V., Mgr., Air Conditioning Division, Higgins Industries, Inc., New Orleans, La.	G. C. Kerr C. B. Gamble	L. V. Cressy W. H. Grant, Jr.
BUSCHMANN, ALFRED W., Mgr., Buschmann Co., Indianapolis, Ind.	G. A. Voorhees W. C. Bevington	S. E. Fenstermaker C. H. Hagedon
CLARK, LYNN W., Salesman, Hall-Neal Furnace Co., Indianapolis, Ind. *(Advancement)*	G. A. Voorhees S. E. Fenstermaker	C. H. Hagedon W. C. Bevington
CORYELL, GLYNN L., Ch. Field Engr., U. S. Machine Corp., Lebanon, Ind.	Ferdinand Jehle J. W. May	Potter Bowles G. A. Voorhees
COTTON, IRWIN W., Owner, The I. W. Cotton Co., Indianapolis, Ind.	G. B. Supple S. E. Fenstermaker	W. C. Bevington C. H. Hagedon
CULBERT, WM. P., Partner, Culbert-Whitby Co., Philadelphia, Pa. *(Advancement)*	M. F. Blankin H. H. Erickson	C. F. Dietz A. E. Kriebel
FEITEL, J. YORK, Pres., Jordy Engineering Co., Inc., New Orleans, La.	H. J. Kelly L. V. Cressy	W. H. Grant, Jr. C. B. Gamble
FENSTERMAKER, S. E., Jr., Field Engr., American Blower Corp., Indianapolis, Ind.	G. B. Supple W. T. Miller	C. H. Hagedon W. C. Bevington
FINN, CHARLES W., Mech. Engr., Boeing Aircraft Corp., Seattle, Wash.	R. D. Morse E. H. Langdon	J. D. Sparks S. D. Peterson
GALLMEIER, SIEGMUND H., Mech. Engr., Argonaot Realty Division—General Motors Corp., Detroit, Mich.	M. B. Shea R. D. Randall	W. H. Old L. A. Bush
GAVIN, JOSEPH A., Mech. Engr., Eastern Aircraft-Trenton Division, General Motors Corp., Trenton, N. J.	*H. E. Ide *S. G. Szabo	*D. A. Hedges *T. H. Moran
GREAR, WALTER W., Engr., Freyn Bros., Inc., Indianapolis, Ind.	C. H. Hagedon S. E. Fenstermaker	G. B. Supple W. C. Bevington
HARDIN, JAMES T., Mgr. of Htg. Dept., Roland M. Cotton Co., Indianapolis, Ind.	S. E. Fenstermaker C. H. Hagedon	G. B. Supple W. C. Bevington

HATTERSLEY, EUGENE H., Member of firm, A. Hattersley & Sons, Ft. Wayne, Ind.	S. E. Fenstermaker C. H. Hagedon	G. B. Supple W. C. Bevington
HOYT, ROBERT A., Supt. of Furnace Installation, Hall-Neal Furnace Co., Indianapolis, Ind.	G. A. Voorhees L. W. Clark	S. E. Fenstermaker C. H. Hagedon
JORDAN, PAUL R., Pres., Paul R. Jordan & Co., Indianapolis, Ind.	G. A. Voorhees W. C. Bevington	S. E. Fenstermaker C. H. Hagedon
JOSLIN, GEO. C., Sales Mgr., Tanner & Co., Indianapolis, Ind.	G. A. Voorhees G. B. Supple	S. E. Fenstermaker W. C. Bevington
KANE, JOHN M., Supervising Engr., American Air Filter Corp., Louisville, Ky.	John Hellstrom H. C. Murphy	Arthur Nutting H. W. Pound
KEARN, JEFF, Mgr., Jeff Kearn Co., Windsor, Ont., Canada.	H. S. Moore A. J. Strain	V. J. Jenkinson W. C. Kelly
LASHLEY, WALTER L., JR., Gen. Foreman of Air Cond., Allison Division of General Motors Corp., Indianapolis, Ind.	Ferdinand Jehle G. B. Supple	R. D. Tutt E. N. Sanbern
LIMBACHER, HOWARD R., Research Engr., Ingersoll Steel & Disc Division, Borg-Warner Corp., Kalamazoo, Mich.	R. C. Cross R. A. Sherman	A. I. Brown L. S. Gifford
MAXWELL, LAWRENCE R., Sales Engr., Southern Heater Company, Inc., New Orleans, La.	N. J. Helwick W. H. Dudley, Jr.	L. V. Cressy W. H. Grant, Jr.
MCGUINESS, C. H., Sales Engr., Carbon Coal Co., Des Moines, Ia.	F. E. Triggs Perry LaRue	B. E. Landes R. H. Schnell
MORRISON, FRANK, Salesman, Hall-Neal Furnace Co., Indianapolis, Ind.	G. A. Voorhees L. W. Clark	W. C. Bevington S. E. Fenstermaker
NATHANSON, M., Engr., Gen. Mgr. & Owner, Canadian Armature Works, Montreal, Que., Canada.	C A Booth A. F. Hamlet	Leo. Garneau J. B. Dykes
NEWTON, ALBERT E., Engr., Hall-Neal Furnace Co., Indianapolis, Ind.	G. A. Voorhees L. W. Clark	S. E Fenstermaker C. H. Hagedon
POST, GERALD A., Mech. Engr., F. H. Langsenkamp Co., Indianapolis, Ind.	S. E. Fenstermaker C. H. Hagedon	G. B. Supple W. C. Bevington
PRYER, ALBERT S., Mech. Engr., Eastern Aircraft-Trenton Division, General Motors Corp., Trenton, N. J.	*H. E. Ide *S. G. Szabo	*D. A. Hedges *T. H. Moran
REED, STANLEY F., Asst. Naval Archt. and Htg. & Vtg. Engr., Kindlund & Drake, New York, N. Y.	A. J. Offner *M. M. Drake	*N. A. Ivanoff *H. C. Blandix
SHUTTLEWORTH, W. R., Design & Test Engr., Allison Division, General Motors Corp., Indianapolis, Ind.	G. B. Supple S. E. Fenstermaker	W. C. Bevington C. W. Stewart
SMITH, GEORGE E., Supv. Engr., Ministry of Works & Planning, Pinner, Middlesex, England. *(Advancement)*	*J. B. Lamond C. B. Morrison	*F. R. G. H. Macrae *J. W. MacInnes
THORPE, WANO E., Estimator-Engr., J. J. Nolan & Co., Memphis, Tenn.	W. J. Oonk R. H. Hoshall	J. D. Flinn J. J. Nolan
TYKLE, FREDERICK G., Plant Engr., Allison Division—General Motors Corp., Indianapolis, Ind.	G. B. Supple R. D. Tutt	W. T. Miller S. E. Fenstermaker

---

*Non-member.

Candidates Elected

In the past issues of the Journal of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each candidate has been assigned by the Committee on Admission and Advancement and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. B-111, Sec. 8, of the By-Laws, the following list of candidates elected:

MEMBERS

CHATFIELD, ARTHUR J., Htg. & Vtg. Engr., Hope's Heating & Lighting, Ltd., London, W. 1, England.

FRANKFURT, W. W., Ch. Mech. Engr., Austin Co., Oklahoma City, Okla.

FRITSCHE, CARL, Htg. Engr., American Radiator & Standard Sanitary Corp., Newark, N. J.

GRANT, WALTER A., Director of Application Engrg., Carrier Corp., Syracuse, N. Y. *(Advancement)*

HILL, HAROLD G., Sr. Draftsman, Toronto Shipbuilding Co., Ltd., Toronto, Ont., Canada. *(Advancement)*

KOEHLER, GEORGE N., Dist. Rep., Minneapolis-Honeywell Regulator Co., New Orleans, La.

LAUBE, HERBERT L., Vice-Pres., Carrier Corp., Syracuse, N. Y.

NUNLIST, F. J. JR., Asst. Ch. Engr., L. J. Mueller Furnace Co., Milwaukee, Wis.

PRICE, WILKES C., Engr., Six Associates, Inc., Nashville, Tenn.

SCHUMACHER, CLARENCE W., Associate Engr.-Mechanical, Army Air Forces Supply Depot, Topeka, Kans. *(Advancement)*

TROLLER, T. H., Dir. of Research, Guggenheim Airship Institute, Akron, Ohio.

WEBER, FRANK J., Manufacturer's Rep., Frank J. Weber & Associates, Buffalo, N. Y.

WILLIAMS, G. M., Consulting Engr., Indianapolis, Ind. *(Reinstatement)*

ASSOCIATES

ANDERSON, SYDNEY, JR., Mgr., Refrig. & Air Cond. Dept., Fairbanks, Morse & Co., Atlanta, Ga.

BERGMAN, A. E., Pres., A. E. Bergman, Inc., St. Paul, Minn.

COYNE, JOHN H., Foreman, Wright Aeronautical Corp., Lockland, Ohio.

DICKINSON, NEVILLE S., Engr. (Owner), Motor Sales & Engineering Co., Inc., Newark, N. J.

HARRINGTON, D. W., Sales-Engr., Dallasair Conditioning Co., Dallas, Texas.

HOLE, KENNETH W., Dir. of Fortifications & Coastal Works, Natal, South Africa.

HUHN, WALTER E., Contractor & Engr., Walter E. Huhn, Waukegan, Ill.

JACKSON, GEORGE O., Pres., Jackson Engineering Co., Indianapolis, Ind. *(Reinstatement)*

MORRISON, W. L., Great Bend, Kans. *(Reinstatement)*

NICHOLS, HOWARD R., Engr., Healy Plumbing & Heating Co., Minneapolis, Minn.

OTTUM, ALVIN L., Htg. & Vtg. Engr., Glenn L. Martin-Nebraska Co., Omaha, Nebr.

PRIDE, HAROLD K., District Mgr., Minneapolis-Honeywell Regulator Co., Milwaukee, Wis.

RUCHTE, CARL O., State Fuel Rationing Officer, Office of Price Administration, Lincoln, Nebr.

SCHULTZ, STEWART F., Mech. Engr., Fisher Cleveland Aircraft Division, General Motors Corp., Cleveland, Ohio *(Reinstatement)*

JUNIORS

GREENWOOD, L. D., Engr., Air Conditioning Co., Houston, Texas.

MINSON, FREDERICK L., Marine Engr., U. S. Maritime Commission, New Orleans, La.

POLAD, THOMAS H., Asst. Ch. Engr., Rudy Furnace Co., Dowagiac, Mich.

Officers

President	M. F. Blankin
First Vice-President	S. H. Downs
Second Vice-President	C.-E. A. Winslow
Treasurer	E. K. Campbell
Secretary	A. V. Hutchinson
Technical Secretary	Carl H. Flink

Council

M. F. Blankin, *Chairman* S. H. Downs, *Vice-Chairman*

Three Years: J. F. Collins, Jr., James Holt, E. N. McDonnell, T. H. Urdahl.

Two Years: L. G. Miller, A. J. Offner, A. E. Stacey, Jr. B. M. Woods.

One Year: E. O. Eastwood, A. P. Kratz, W. A. Russell, L. P. Saunders.

Council Committees

Executive—E. O. Eastwood, *Chairman;* A. P. Kratz, E. N. McDonnell

Finance—J. F. Collins, Jr., *Chairman;* C.-E. A. Winslow, B. M. Woods.

Membership—E. K. Campbell, *Chairman;* A. J. Offner, W. A. Russell.

Meetings—S. H. Downs, *Chairman;* James Holt.

Standards—L. P. Saunders, *Chairman;* L. G. Miller, T. H. Urdahl.

•

Advisory Council

E. O Eastwood, *Chairman;* Homer Addams, D. S. Boyden, W. H. Carrier, S. E. Dibble, W. H. Driscoll, W. L. Fleisher, H. P. Gant, F. E. Giesecke, E. Holt Gurney, L. A. Harding, H M. Hart, C. V. Haynes, E. Vernon Hill, John Howatt, W T. Jones, D. D. Kimball, G. L. Larson, S. R. Lewis, Thornton Lewis, J. F. McIntire, F. B. Rowley and A. C. Willard.

Special Committees

Admission and Advancement: E. P. Heckel, *Chairman (one year);* T. T. Tucker *(two years);* H. Berkley Hedges *(three years).*

ASHVE-ASTM-ASRE-NRC Committee on Thermal Conductivity—F C Houghten, *Chairman;* C. B. Bradley, H. C. Dickinson, R. H. Heilman, E. R. Queer, F. B. Rowley, T. S. Taylor, G. B. Wilkes.

ASHVE-IES Joint Committee on Lighting and Air Conditioning—P. M. Rutherford, Jr., *Chairman;* W. R. Beach, B. C. Candee, W. G. Darley, Bruce Jensen, C. L. Kribs, Jr.

Chapter Development Committee—W. A. Russell, *Chairman;* Albert Buenger, C. E. Price.

Chapter Relations—J. F. Collins, Jr., *Chairman;* L. P. Saunders, H. E. Sproull.

Constitution and By-Laws—L. T. Avery, *Chairman;* M. W. Bishop, R. A. Miller.

F. Paul Anderson Award—S. H. Downs, *Chairman;* Tom Brown, F. E. Giesecke, L. L. Lewis and F. B. Rowley.

Guide Publication—P. D. Close, *Chairman;* Thomas Chester, John James, S. Konzo, C. S. Leopold.

Publication—C. H B. Hotchkiss, *Chairman (one year);* J. H. Walker *(two years);* L. E. Seeley *(three years).*

War Service—John Howatt, *Chairman;* W. H. Driscoll, E. N. McDonnell, L. E. Seeley, B. M. Woods.

Nominating Committee

Chapter	*Representative*	*Alternate*
Atlanta	T. T. Tucker	L. F. Kent
Cincinnati	M. E Mathewson	E. W. McNamee
Connecticut	L. E. Seeley	H. E Adams
Delta	G. E. May	G. C. Kerr
Golden Gate	B. M. Woods	
Illinois	E. M. Mittendorff	A. O. May
Iowa	F. E. Triggs	C. W. Helstrom
Kansas City	L. T. Mart	M M. Rivard
Manitoba	Ivan McDonald	Einar Anderson
Massachusetts	E. G. Carrier	A. C. Bartlett
Michigan	M. B. Shea	S. S. Sanford
Minnesota	R. E. Backstrom	William McNamara
Montreal	G P. Ste-Marie	R. R. Noyes
New York	H. H. Bond	C. S. Koehler
Nebraska	B. G. Peterson	W. R. White
North Carolina	F. E. P. Klages	Arvin Page
North Texas	T. H. Anspacher	
Oklahoma	E. T. P Ellingson	E F. Dawson
Ontario	V. J. Jenkinson	H. R. Roth
Oregon	B. V Farnes	
Pacific Northwest	R. D. Morse	E. H. Langdon
Philadelphia	H. H. Mather	Edwin Elliot
Pittsburgh	E C. Smyers	E. H. Riesmeyer, Jr.
St. Louis	C. F. Boester	M. F. Carlock
South Texas	J. A. Walsh	A. J. Rummel
Southern California	W. O. Stewart	Leo Hungerford
Washington, D. C.	J. W Markert	F. A. Leser
Western Michigan	T. D. Stafford	L. G. Miller
Western New York	H. C. Schafer	S. M. Quackenbush
Wisconsin	C. H. Randolph	Ernest Szekely

Officers of Local Chapters

Atlanta: Organized, 1937. Headquarters, Atlanta, Ga. Meets, First Monday. President, A. H. Koch, 3687 Peachtree Rd. Secretary, L. F. Lawrence, Jr., 304-101 Marietta St., Atlanta 3. **Cincinnati:** Organized, 1932. Headquarters, Cincinnati, O. Meets, Second Tuesday. Honorary President, Capt. C. E. Hust, President, Albert Buenger, Hotel Gibson. Secretary, E. J. Richard, 2137 Reading Rd., Cincinnati 2. **Connecticut:** Organized, 1940. Headquarters, New Haven, Conn. President, C. J. Lyons, Wilson Ave., S. Norwalk. Secretary, J. R. Smak, 160 Morehouse Highway, Fairfield. **Delta:** Organized, 1939. Headquarters, New Orleans, La. Meets, Second Tuesday. President, L. V. Cressy, 423 Baronne St., New Orleans 13. Secretary, J. S. Burke, 317 Baronne St., New Orleans 9. **Golden Gate:** Organized, 1937. Headquarters, San Francisco, Calif. Meets, First Wednesday. President, R. A. Folsom, 150 Hooper St. Secretary, R. B. Holland, 1275 Folsom St. **Illinois:** Organized, 1906. Headquarters, Chicago, Ill. Meets, Second Monday. President, Chas. E. Price, Room 1605, 6 N. Michigan Ave., Chicago 2. Secretary, C. M. Burnam, Jr., Room 1605, 6 N. Michigan Ave., Chicago 2. **Indiana:** Organized, 1943. Headquarters, Indianapolis, Ind. President, S. E. Fenstermaker, 937 Architects and Builders Bldg. Secretary, C. W. Stewart, 1001 York St.

• • •

Iowa: Organized, 1940. Headquarters, Des Moines, Ia. Meets, Second Tuesday. President, C. W. Helstrom, 1614 Thompson. Secretary, B. E. Landes, 1603 47th St., Des Moines 10. **Kansas City:** Organized, 1917. Headquarters, Kansas City, Mo. Meets, Second Monday. President, L. T. Mart, 3001 Fairfax Rd., Kansas City, Kans. Secretary, F. S. Pexton, 824 Grand Ave., Kansas City 13, Mo. **Manitoba:** Organized, 1935. Headquarters, Winnipeg, Man. Meets, Third Thursday. President, F. L. Chester, 179 Bannatyne Ave. Secretary, F. T. Ball, 810 9th Ave., W., Calgary, Alta. Acting Secretary, Einar Anderson, 152 Bannerman Ave., Winnipeg. **Massachusetts:** Organized, 1912. Headquarters, Boston, Mass. Meets, Third Tuesday. President, E. G. Carrier, 704 Statler Bldg. Secretary, R. T. Kern, 51 Claflin St., Leominster. **Michigan:** Organized, 1916. Headquarters, Detroit, Mich. Meets, First Monday after 10th of month. President, S. S. Sanford, 2000 Second Ave. Secretary, A. E. Knibb, 1003 Maryland Ave., Detroit 30. **Minnesota:** Organized, 1918. Headquarters, Minneapolis, Minn. Meets First Monday. President, D. B. Anderson, 1999 Pinehurst Ave., St. Paul. Secretary, R. E. Gorgen, Wesley Temple Bldg., Minneapolis.

• • •

Montreal: Organized 1936. Headquarters, Montreal, Que. Meets Third Monday. President, F. A. Hamlet, 1010 St. Catherine St., W. Secretary, R. R. Noyes, 630 Dorchester St., W. **Nebraska:** Organized, 1940. Headquarters, Omaha. Meets, Second Tuesday. President, G. E. Merwin, 5012 Parker St., Secretary E. F. Adams, 1227 So. 52nd St. **New York:** Organized, 1911. Headquarters, New York, N. Y. Meets, Third Monday. President, R. A. Wasson, 500 Fifth Ave. Secretary, P. G. Griess, 189 Walnut Ave., Bogota, N. J. **North Carolina:** Organized, 1939. Headquarters, Durham, N. C. Meets, Quarterly. President, F. J. Reed, 263 College Station. Secretary, C. Z. Adams, 312 Piedmont Bldg., Greensboro. **North Texas:** Organized, 1938. Headquarters, Dallas, Tex. Meets, Second Monday. President, M. L. Brown, 3500 Commerce St. Secretary, E. T. Gessell, Thomas Bldg. **Northern Ohio:** Organized, 1916. Headquarters, Cleveland, O. Meets, Second Monday. President, P. D. Gayman, 2142 E. 19th St. Secretary, G. B. Priester, Case School of Applied Science, Cleveland 6.

• • •

Oklahoma: Organized, 1935. Headquarters, Oklahoma City, Okla. Meets, Second Monday. President, E. F. Dawson, University of Oklahoma, Norman. Secretary, E. T. P. Ellingson, 314 Savings Bldg., Oklahoma City 2. **Ontario:** Organized, 1922. Headquarters, Toronto, Ont. Meets, First Monday. President, W. C. Kelly, 602 King St., W. Secretary, H. R. Roth, 57 Bloor St., W. **Oregon:** Organized, 1939. Headquarters, Portland, Ore. Meets, Thursday after First Tuesday. President, J. A. Freeman, 1623 S. E. 11th Ave. Secretary, G. H. Risley, 516 S. W. Oak St., Portland 4. **Pacific Northwest:** Organized, 1928. Headquarters, Seattle, Wash. Meets, Second Tuesday. President, R. D. Morse, 4404 White Bldg. Secretary, J D. Sparks, 7331 W Green Lake Way, Seattle 3. **Philadelphia:** Organized, 1916. Headquarters, Philadelphia, Pa. Meets, Second Thursday. President, Edwin Elliot, 560 N. 16th St. Secretary, E. H. Dafter, Room 2211, 12 S. 12th St., Philadelphia 7. **Pittsburgh:** Organized, 1919. Headquarters, Pittsburgh, Pa. Meets, Second Monday. President, G. G. Waters, 1841 Oliver Bldg. Secretary, E. H. Riesmeyer, Jr., 231-33 Water St., Pittsburgh 22.

• • •

St. Louis: Organized, 1918. Headquarters, St. Louis, Mo. Meets, First Tuesday. President, C. F. Boester, 101 E. Essex, Kirkwood. Secretary, B. C. Simons, Rm. 706, 4030 Chouteau, St. Louis 10. **South Texas:** Organized, 1938. Headquarters, Houston, Texas. Meets, Third Friday. President, A. M. Chase, Jr., Box 359. Secretary, A. F. Barnes, 602 Kirby Bldg., Houston 2. **Southern California:** Organized, 1930. Headquarters, Los Angeles, Calif. Meets, Second Wednesday. President, W. O. Stewart, 153 W. Avenue 34. Secretary, Maron Kennedy, 5051 Santa Fe Ave. **Washington, D. C.:** Organized, 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. President, S L. Gregg, 4828 Edgemoor Lane, Bethesda, Md. Secretary, A. S. Gates, Jr., 111 County Rd., Kensington, Md. **Western Michigan:** Organized, 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. President, C. H. Pesterfield, Michigan State College, East Lansing. Secretary, V. H. Hill, 2111 Colvin Court, Lansing 10. **Western New York:** Organized 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. President, S. M. Quackenbush, 117 W. Tupper St. Secretary, Herman Seelbach, Jr., 45 Allen St. **Wisconsin:** Organized, 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. President, F. W. Goldsmith, 513 E. Day Ave. Secretary, E. W. Gifford, 611 N. Broadway.

Committee on Research

C. M. ASHLEY, *Chairman*

H. J. ROSE, *Vice-Chairman*

CYRIL TASKER, *Director of Research*

C. M. HUMPHREYS, *Acting Director, Research Laboratory*

J. H. WALKER, *Technical Adviser*

A. C. FIELDNER, *Ex-Officio Member*

Three Years: H. J. ROSE, L. P. SAUNDERS, L. E. SEELEY, A. E. STACEY, JR.

Two Years: C. F. BOESTER, JOHN A. GOFF, W. E. HEIBEL, C. A. MCKEEMAN, C.-E. A. WINSLOW.

One Year: C. M. ASHLEY, M. K. FAHNESTOCK, H. KING MCCAIN, F. C. MCINTOSH, T. H. URDAHL.

Executive Committee: C. M. ASHLEY, *Chairman;* F. C. MCINTOSH, M. K. FAHNESTOCK, H. J. ROSE, T. H. URDAHL.

Finance Committee: E. N. MCDONNELL, *Chairman.*

Nicholls Award to Kreisinger

The Percy Nicholls award "for notable scientific or industrial achievement in the field of solid fuels" was awarded to Henry Kreisinger, New York engineer, on October 28, 1943, at the annual Joint Fuels Conference of the fuels division, *American Society of Mechanical Engineers,* and the coal division, *American Institute of Mining and Metallurgical Engineers* at the William Penn Hotel, Pittsburgh, Pa. Mr. Kreisinger is manager of the development and research department, Combustion Engineering Co., Inc., New York.

"His contribution to the organized study of the coals of the United States and his research work in the utilization of solid fuels have helped greatly in the development of the science of fuel technology," said the citation. "His years of study of the process of combustion have developed for all mankind a greater knowledge of phenomena involved and have led to a more thorough understanding of the basic and practical aspects of the economical burning of solid fuels.

"His personal contribution to the development of the safe and economical use of pulverized coal has added greatly to the usefulness of solid fuels not otherwise economically useful and has, thereby, in effect, vastly increased the amount of fuel energy available for the use of mankind."

The award, presented for the second time this year, was named for the late Percy Nicholls, who was supervising fuel engineer of the U. S. Bureau of Mines, a Life Member of ASHVE and a former member of its research staff.

Technical Advisory Committees

1. *Sensations of Comfort:* Thomas Chester, *Chairman;* N. D. Adams, C. R. Bellamy, G. D. Fife, E. P. Heckel, F. C. McIntosh,* A. B. Newton, B. F. Raber.
2. *Physiological Reactions:* R. W. Keeton, M.D., *Chairman.*
3. *Removal of Atmospheric Impurities:* R. S. Dill, *Chairman;* J. J. Burke, J. M. DallaValle, Leonard Greenburg, M.D., Theodore Hatch, W. C. L. Hemeon, L. R. Koller, C. A. McKeeman,* F. H. Munkelt, H. C. Murphy, G. W. Penney, E. B. Phelps, F. B. Rowley, J. B. Smith, W. O. Vedder, J. H. Waggoner, R. P. Warren, W. F. Wells.
4. *Radiation and Comfort:* J. C. Fitts, *Chairman;* E. L. Broderick, R. E. Daly, L. N. Hunter, F. W. Hutchinson, A. P. Kratz, John James, C. S. Leopold, D. W. Nelson, G. W. Penney, W. R. Rhoton, T. H. Urdahl.*
5. *Instruments:* D. W. Nelson, *Chairman;* L. M. K. Boelter, E. L. Broderick, R. S. Dill, R. B. Engdahl, A. P. Gagge, J. A. Goff,* J. D. Hardy, A. E. Hershey, F. W. Reichelderfer, G. L. Tuve, C. P. Yaglou.
6. *Weather Design Conditions:* T. H. Urdahl,* *Chairman;* J. C. Albright, H. S. Birkett, P. D. Close, J. F. Collins, Jr., John Everetts, Jr., C. M. Humphreys, H. H. Koster, J. W. O'Neill, F. W. Reichelderfer.
7. *Radiation with Gravity Air Circulation:* M. K. Fahnestock,* *Chairman;* R. E. Daly, R. S. Dill, A. G. Dixon, F. E. Giesecke, H. F. Hutzel, J. P. Magos, J. W. McElgin, J. F. McIntire, W. A. Rowe.
8. *Heat Transfer of Finned Tubes:* W. E. Heibel,* *Chairman;* William Goodman, H. F. Hutzel, Ferdinand Jehle, S. F. Nicoll, R. H. Norris, L. P. Saunders,* R. J. Tenkonohy, G. L. Tuve, D. C. Wiley.
9. *Cooling Load in Summer Air Conditioning:* W. E. Zieber, *Chairman;* John Everetts, Jr., W. F. Friend, R. H. Heilman, John James, C. S. Leopold, C. O. Mackey, A. E. Stacey, Jr.,* G. E. Tuckerman, J. H. Walker,* M. J. Wilson.
10. *Air Distribution and Air Friction:* J. H. Van Alsburg, *Chairman;* S. H. Downs, A. P. Kratz, E. C. Lloyd, R. D. Madison, L. G. Miller, D. W. Nelson, C. H. Randolph, L. P. Saunders,* M. C. Stuart, Ernest Szekely, G. L. Tuve.
11. *Heat Requirements of Buildings:* P. D. Close, *Chairman;* E. K. Campbell, J. F. Collins, Jr., E. F. Dawson, W. H. Driscoll, H. H. Mather, H. K. McCain,* M. W. McRae, C. H. Pesterfield, F. B. Rowley, R. K. Thulman.
12. *Air Conditioning Requirements of Glass:* R. A. Miller, *Chairman;* L. T. Avery, F. L. Bishop, W. A. Danielson, H. C. Dickinson, J. D. Edwards, J. E. Frazier, E. H. Hobbie, C. L. Kribs, Jr., Axel Marin, F. W. Parkinson, W. C. Randall, L. E. Seeley,* L. T. Sherwood, J. T. Staples, H. B. Vincent, G. B. Watkins, F. C. Weinert.
13. *Sound Control:* R. D. Madison, *Chairman;* W. W. Kennedy, V. O. Knudsen, C. H. Randolph, A. E. Stacey, Jr.,* A. G. Sutcliffe, T. A. Walters, R. M. Watt, Jr.
14. *Cooling Towers, Evaporative Condensers and Spray Ponds:* H. B. Nottage, *Chairman;* C. F. Boester,* W. W. Cockins, S. C. Coey, E. H. Kendall, E. R. Ketchum, S. R. Lewis, J. F. Park, S. I. Rottmayer, E. W. Simons, E. H. Taze.
15. *Psychrometry:* J. A. Goff,* *Chairman;* F. R. Bichowsky, W. H. Carrier, H. C. Dickinson, R. S. Dill, A. W. Gauger, William Goodman, A. M. Greene, Jr., L. P. Harrison, F. G. Keyes, A. P. Kratz, D. M. Little, Axel Marin, D. W. Nelson, W. M. Sawdon.
16. *Flow of Fluids Through Pipes and Fittings:* F. E. Giesecke, *Chairman;* T. M. Dugan, S. R. Lewis, L. P. Saunders.*
17. *Fuels:* R. A. Sherman, *Chairman;* R. M. Conner, R. S. Dill, R. B. Engdahl, A. C. Fieldner, L. N. Hunter, S. Konzo, W. M. Myler, Jr., H. J. Rose,* C. E. Shaffer, T. H. Smoot, R. K. Thulman, T. H. Urdahl,* E. C. Webb.
18. *Corrosion:* L. F. Collins, *Chairman;* R. C. Doremus, E. W. Guernsey, G. G. Marvin, A. R. Mumford, L. P. Saunders,* F. N. Speller.
19. *Air Conditioning in Industry:* W. L. Fleisher, *Chairman;* L. T. Avery, A. R. Behnke, M.D., Leonard Greenburg, M.D., W. E. Heibel,* F. C. Houghten, D. E. Humphrey, E. F. Hyde, L. L. Lewis, P. A. McKittrick, R. R. Sayers, M.D., R. M. Watt, Jr., H. E. Ziel.
20. *Sorbents:* F. R. Bichowsky, *Chairman;* O. D. Colvin, F. Dehler, John Everetts, Jr., Ralph Fehr, J. A. Goff,* W. R. Hainsworth, C. H. B. Hotchkiss, J. C. Patterson, G. L. Simpson.
21. *Insulation:* E. R. Queer, *Chairman;* J. D. Edwards, F. G. Hechler, H. K. McCain,* Paul McDermott, W. T. Miller, H. C. Robinson, F. B. Rowley, G. L. Tuve, J. H. Waggoner, G. B. Wilkes.
22. ***Heavy Duty Air Heating Furnaces:*** **E. K. Campbell, *Chairman;* H. D. Campbell, K. T. Davis, A. P. Kratz, W. J. MaGirl, A. A. Olson, B. B. Reilly, H. J. Rose,* H. A. Soper.**

---

*Member of Committee on Research.

Heating Piping & Air Conditioning

with which is merged the Aerologist

Design, Installation,
Operation, and Maintenance:
Industrial, Commercial,
and Large Buildings

Board of Consulting & Contributing Editors

N. R. Bernz, Sabin Crocker, R. C. Doremus, Philip Drinker, Walter L. Fleisher, F. E. Giesecke, William Goodman, William A. Hanley, J. J. Harman, R. S. Hawley, E. P. Heckel, R. E. Hieronymus, J. C. Hornung, John Howatt, Lee P. Hynes, C. W. Kimball, Dwight D. Kimball, A. C. Kirkwood, Charles S. Leopold, Samuel R. Lewis, H. C. Murphy, Alfred J. Offner, F. B. Rowley, Robert P. Schoenijahn, Kalman Steiner, T. S. Tenney, Rush D. Touton, Eph. A. Tyler, W. H. Wilson

Editor
C. M. Burnam Jr.

Assistant Editor
Margaret Marshall

Advertising Staff

Wallace J. Osborn
New York
Telephone: Murray Hill 9-8293

James D. Thomas
Chicago
Telephone: State 6916

Robert A. Jack
Cleveland
Telephone: Yellowstone 1540

J. Howard Tinkham
Los Angeles
Telephone: Richmond 6191

Publisher
Frank P. Keeney

Manager
Chas. E. Price

Published monthly by the Keeney Publishing Co., 6 N. Michigan Ave., Chicago 2. Telephone: State 6916. Subscriptions: U. S. and possessions, Canada, Mexico, Central America, South America, $2.00 per year; other, $4.00. Current copies, U. S. and possessions, 25c each, back copies 50c each. January 1943 issue, $1.00 per copy. Member of Audit Bureau of Circulations and the Associated Business Papers, Inc. Copyright 1943 by the Keeney Publishing Co.

CONTENTS THIS MONTH

December 1943 • Vol. 15, No. 12

The Editor's Pages (news and comment) .... front section 67

How Control of the Air in Industry Is Helping to Win the Battle of Production, by Gordon Midboe 623

Sam Lewis' Page—Steam Heating Systems with Overhead Returns 629

New Test Method Shows Efficiency of Kitchen Range Grease Filters, by M. H. Kliefoth and D. L. Hunzicker 630

Measuring the Flow of Fluids, by William Goodman 632

Requirements for Instrument Piping and Castings To Be Added to Pressure Piping Code 636

The Drying of Foods, by W. R. Marshall, Jr. 637

"Open for Discussion" (coordinating building dimensions ... postwar planning ... cold bending pipe) 642

Penicillin Process Requires Rigorous Temperature Control 644

Air Conditioned Operating Rooms Have Five Advantages 648

School Engineers Declare War on Fuel Waste 645

Big Gravity Ventilation System Serves Kaiser's New Steel Mill, by George E. Skaggs 647

Maintain Manpower (health maintenance of men and plants) 650

How to Design Safety Valve Vent Piping of the Umbrella Type, by Max W. Benjamin 655

WPB ... OPA ... PAW ... Etc. (new government orders and news releases; also see p. 158, back section) 660

Equipment Developments .... back section 137

Recent Trade Literature .... back section 146

New Books & Reports .... back section 152

Meetings & Conventions .... back section 162

Index to Advertisers .... back section 164

[Front cover photo from Shigeta-Wright]

Journal Section of the American Society of Heating and Ventilating Engineers

50th Annual Meeting 665

A Study of Intermittent Heating of Churches, by F. E. Giesecke 669

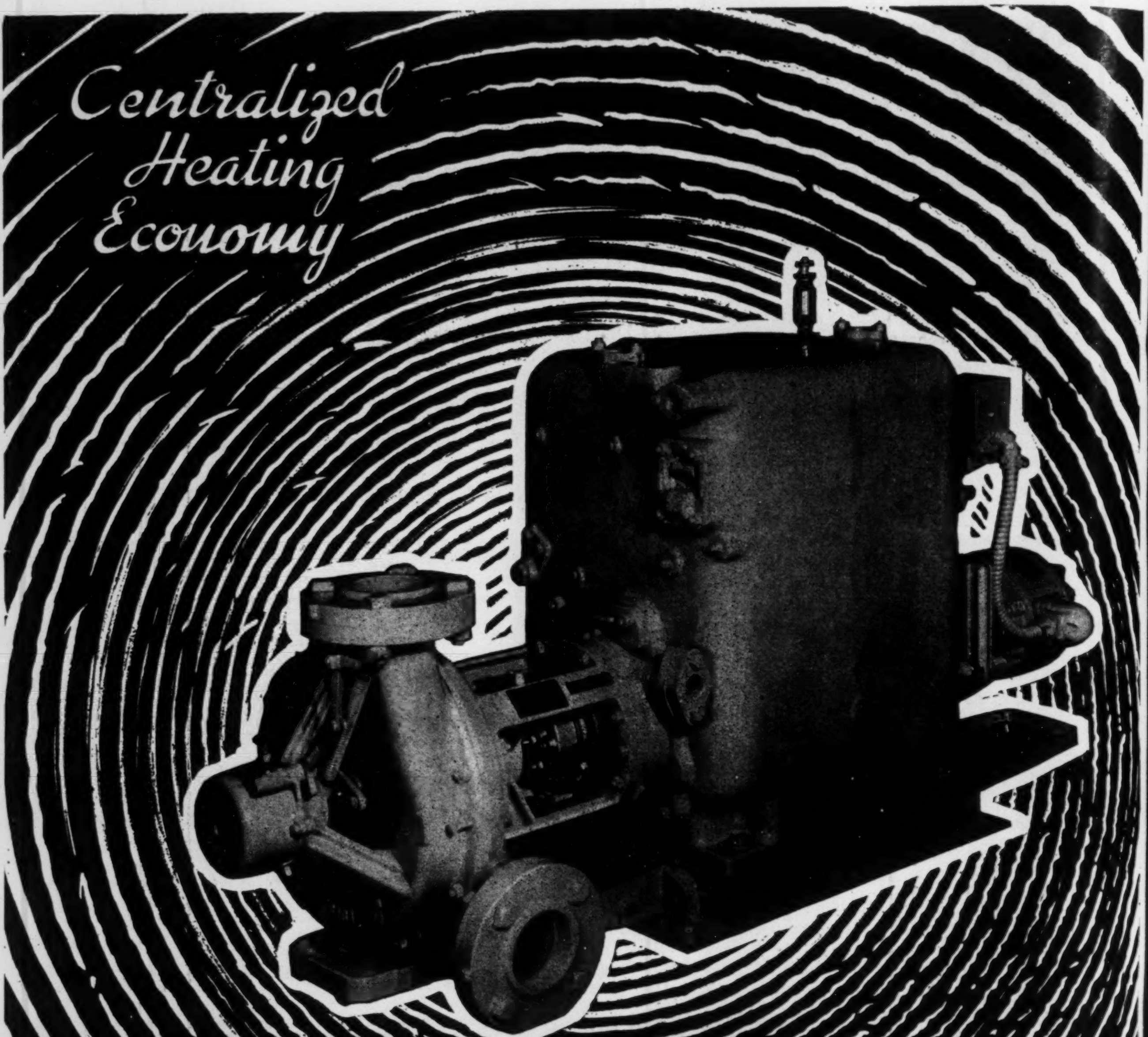
Nominees for Committee on Research 674

Summary of Local Chapter Meetings 676

Candidates for Membership 678

Candidates Elected 680

Officers, Council, and Committees 681



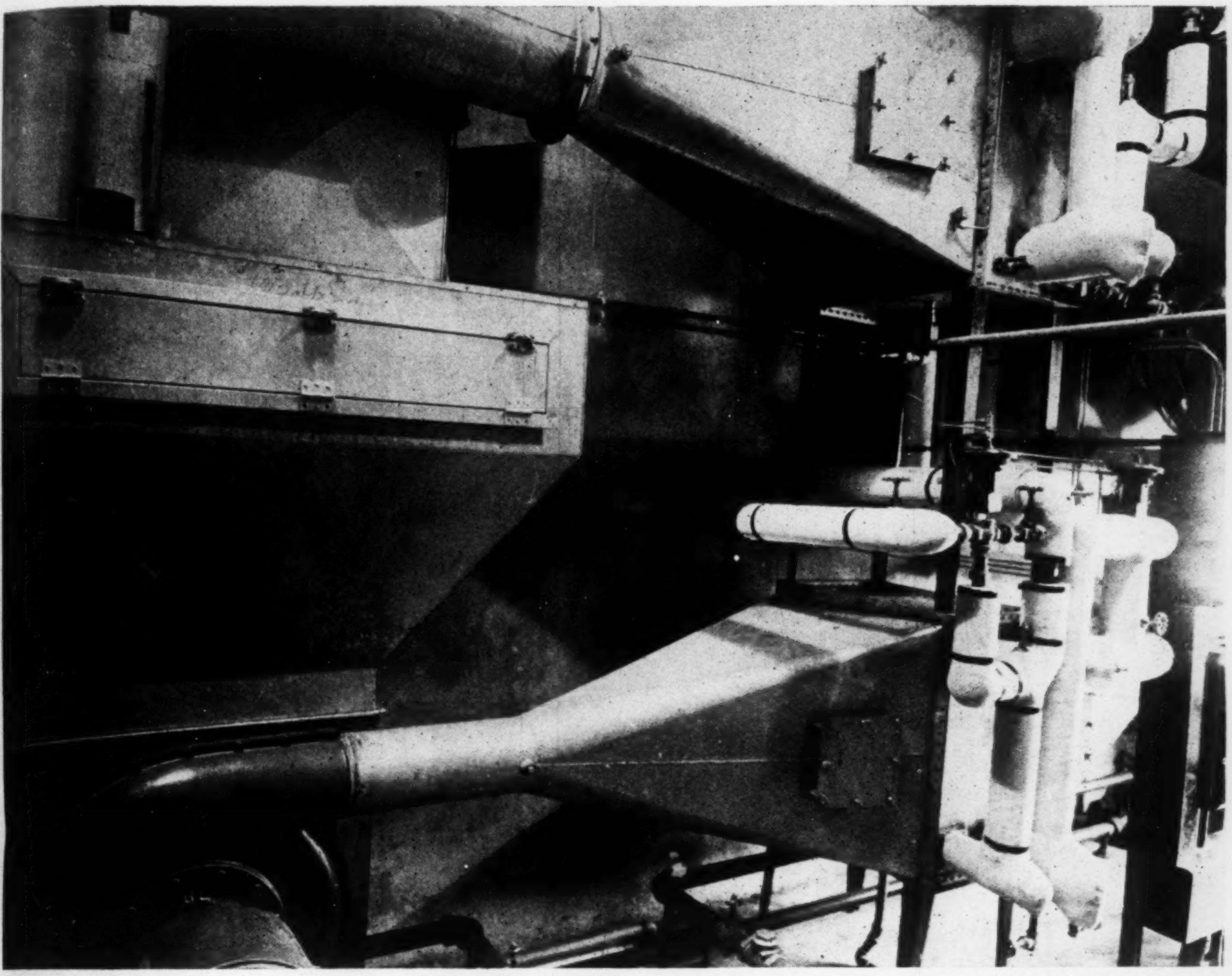
A RETURN LINE VACUUM PUMP THAT CUTS HEATING COST.

This unusual pump needs no electric current, cutting out greatest item of pump operating expense.

More important, this pump insures absolutely uniform circulation in system. That means continuous steam economy.

Simple, compact, one moving element, no wearing parts, no internal lubrication. Bulletin No. 203 gives the facts. Your copy is waiting.

THE NASH ENGINEERING COMPANY
SOUTH NORWALK, CONNECTICUT, U. S. A.



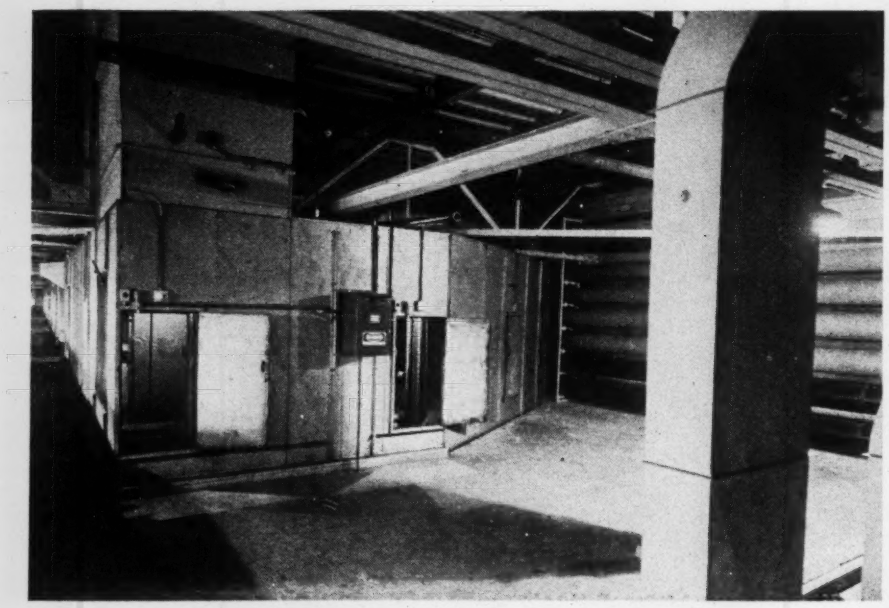
Pressure and temperature control of the carburetor air for engine testing is obtained by the ramming blower and the combination heating and cooling coil. Both the chilled water and 240 F hot water connections to the coils can be seen. Outside air is taken in through the roof, filtered, and blown through the heavy gage, welded and hot dipped galvanized duct and delivered to the carburetor

How Control of the Air in Industry Is Helping to Win the Battle of Production

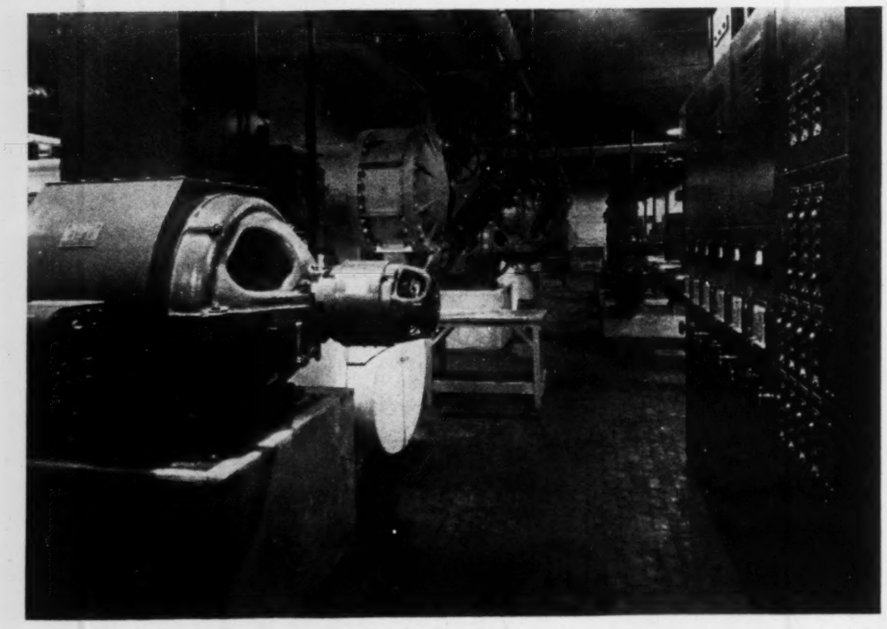
PRECISION MANUFACTURING of aircraft engines on a mass production basis has reached new peaks of perfection, volume, and efficiency at a new plant of the Jacobs Aircraft Engine Co. This achievement was reached through careful planning, employment of the latest equipment, development of new methods, and conditioning the worker's environment for maximum efficiency.

The role of the heating, piping, and air conditioning industry was a major one in designing and providing the facilities to assist in the thousands of operations required to produce airplane engines and it was through an appreciation of this fact by the government and design engineers in the preliminary planning of the project that the

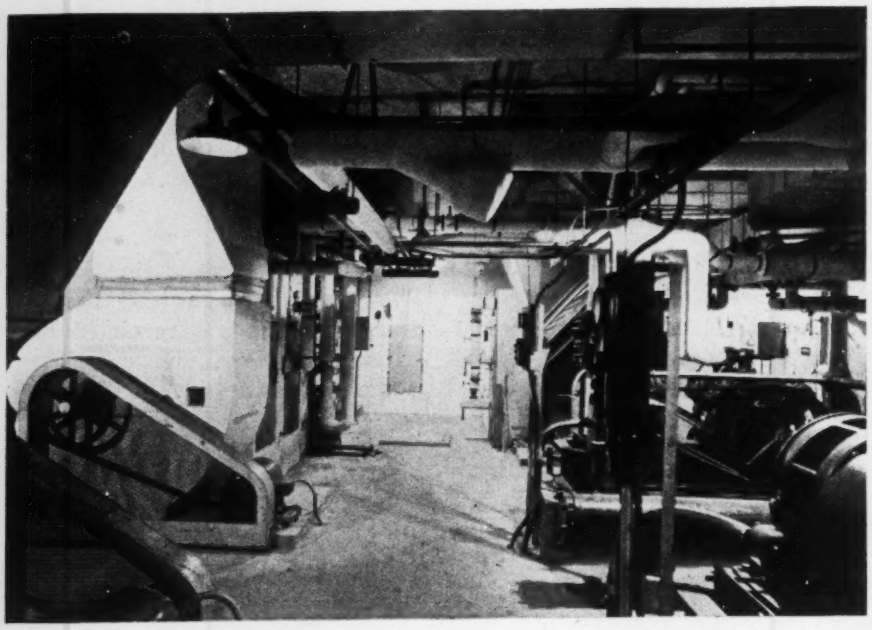
Gordon Midboe, Project Engineer, Kerby Saunders Inc., Describes Heating, Piping, and Air Conditioning Services in Aircraft Engine Plant and Tells How They Aid Precision Manufacture



The air units for the main area are on a mezzanine with the supply ductwork running through the roof trusses. The electric precipitation type filters are inside the casing by the power pack, with outside air coming down from the roof and the return air entering through the screen on the front side of the unit. Chilled and hot water mains can be seen in the background



Three of the 500 hp centrifugal compressors for the water cooling system. In the right foreground is the starting and control equipment for the synchronous motors. In the background are the condenser water pumps



The unitary type of refrigeration system is utilized for areas which are remote and where load variation and period of operation vary with the central system. This view shows the direct expansion cafeteria system

heating, piping, and air conditioning services were not handled as a minor consideration with all emphasis being given to manufacturing methods only.

Dictated by wartime demands for complete blackout, the buildings are completely windowless with practically all areas air conditioned.

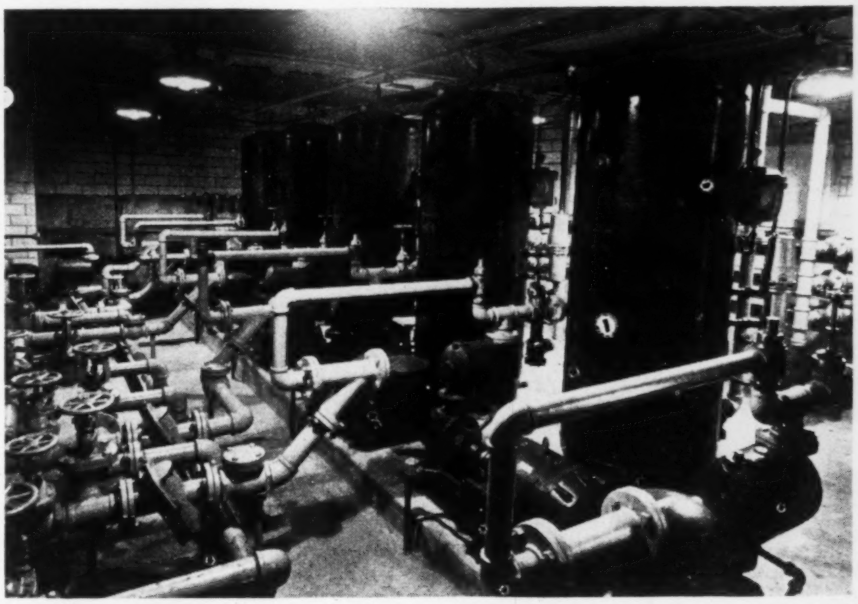
With 11 acres of machine shop area, 11½ acres of miscellaneous areas, a three story office building with basement and numerous other auxiliary spaces, arrangement and location of buildings, machines and personnel was of the greatest significance to obtain the most efficient flow of materials. Rough castings start at one end of the main area, pass through the various machining operations, ending at the assembly line at the other end of the main area, finally leaving this area as a completed engine. From here, the engine passes to another area for testing. Two mezzanines are provided for the air conditioning equipment with the spaces below utilized for shop offices and tool rooms. Two levels under the main area contain storage, locker rooms, toilets, carpenter shops, pipe and welding shops, cafeterias, kitchens, refrigeration machine rooms, and a miscellaneous group of maintenance areas.

Why Air Conditioning Is Necessary

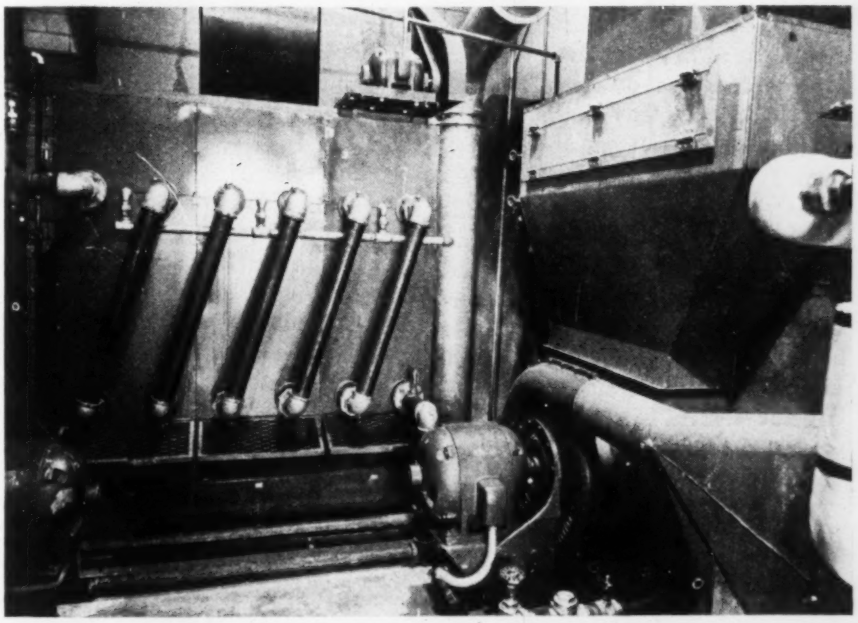
With windowless construction, ventilation is, of course, a prime requisite. But with the high precision requirements, another problem of paramount importance presented itself. This was the fact that the machined parts would change dimensions with a change in temperature. In other words, if certain machined parts made at a temperature of 90 F were assembled with parts machined at a temperature of 70 F the tolerance requirements could not be met. Also, under certain conditions of temperature and humidity, moisture would condense and form on machined surfaces. It is these factors which prompted the decision to provide cooling for operation during the warm season and remove the heat and moisture due to sun, outside temperature, and the large internal load. As a secondary result of providing this cooling, but of prime importance as far as employee efficiency is concerned, is the fact that comfortable working conditions are provided. Cooling in the office building, cafeterias, and remaining areas is provided for the express purpose of increasing employee efficiency, the advantages of which are obvious.

The resultant savings in rejected and spoiled parts, together with a better product, is in itself sufficient to justify the installation. Add to this the rather intangible but decidedly advantageous effect of higher employee efficiency and we have a distinct return on every dollar invested. The results observed in the operation of the plant only supplement previous observations by the air conditioning industry that the trend toward air conditioned factories is both practical and economically sound.

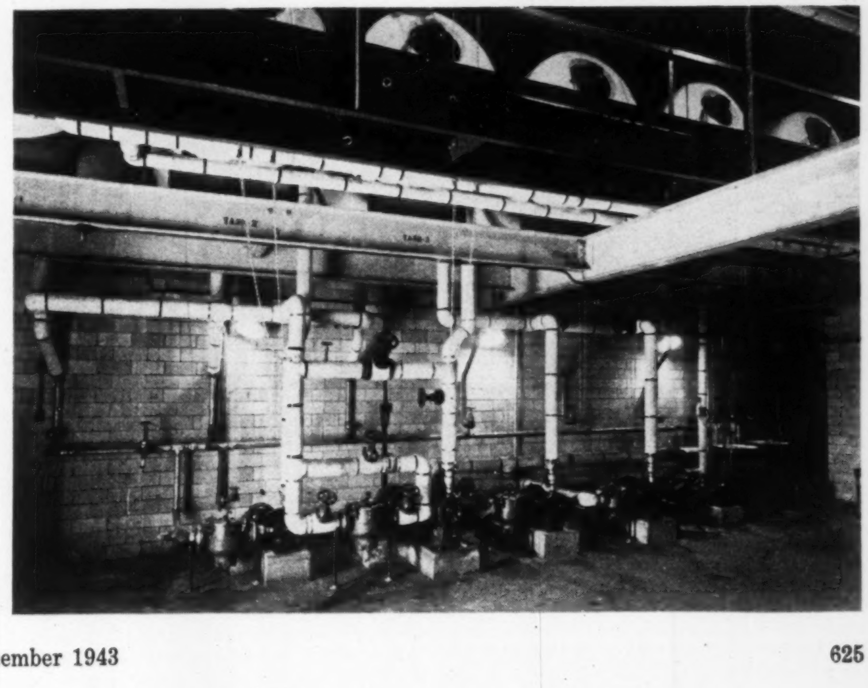
The type of cooling selected was a combination of a central and a



One of several gasoline pumphouses. The gasoline is pumped from storage tanks into the pressure tanks shown and from this point distributed to the individual test cells



Evaporative type coolers are used to remove the heat from the lubricating oil used for engine testing. The coolant is circulated through a closed circuit coil in the cooler and then through a shell and tube oil cooler. The ramming blower shown is for the engine carburetor air



The lubricating oil for engine testing is stored, processed, and pumped to the individual test cells

remote unitary system. Each area was carefully analyzed as to magnitude of load, variation in load, period of required operation, type of operation, and location of unit. By considering and utilizing the advantages of both the central and the unitary systems, the combination type was the logical selection.

Combination Central and Unitary System

The central water cooling system was selected for the main manufacturing area chiefly because the close proximity of the air units running in a straight line the length of the building permitted installing one set of chilled water mains of comparatively short length. Space was also available for the main machine room in a central location in relation to the units. In addition, the variation in load and period of operation for the entire area was similar.

However, it was not feasible to install chilled water mains to serve areas as remote as the office building system, whose load and period of operation vary widely from the main area. Consequently, 15 unitary systems were set up for such areas where location, variation of load, and period of operation ruled out the central system. This includes, in addition to the office building, such areas as laboratory, gage room, first aid rooms, cafeterias, test cells, etc. Thus, the combination system resulted in an overall balanced system from the standpoints of initial costs, operating costs, maintenance, and operation.

Using condenser water cooled by an induced draft redwood cooling tower, the five centrifugal type refrigeration compressors have a combined capacity of 3050 tons. Synchronous motors, operating at 4160 volts, drive the compressors through flexible couplings and helical gear speed increasers. Also located in the machine room are five centrifugal chilled water pumps circulating 9000 gpm. Manual operation of the capacity control valve in the compressors is used for variation of load requirements.

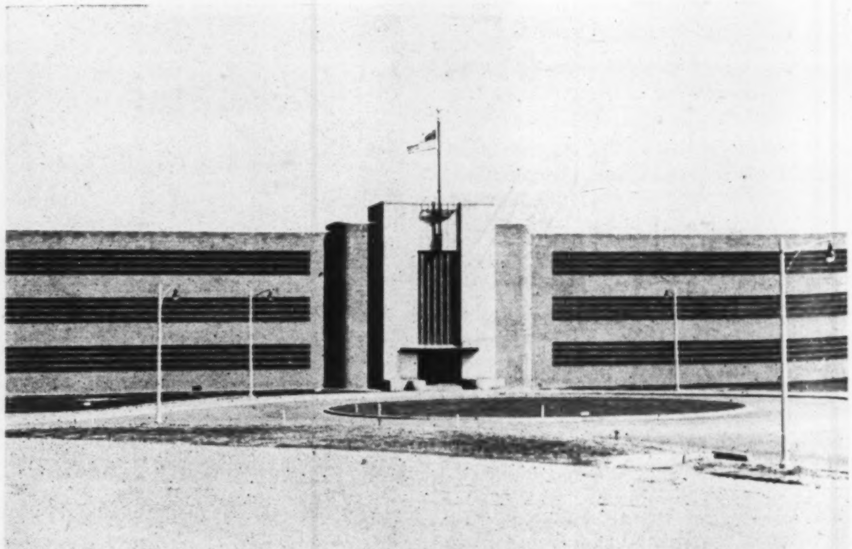
The 15 unitary systems, with an approximate combined capacity of 600 tons, utilize high speed, reciprocating, "Freon-12" refrigeration condensing units ranging in size from 7½ to 60 hp. Nine of the units have evaporative type condensers; for the remainder, relatively cool water is available from other processes for condensing.

Air distribution in the main manufacturing area is accomplished by a series of parallel supply ducts stemming from the air units located on the mezzanine. The ducts run through the trusses, with ceiling type outlets extending from the bottoms of the ducts to points approximately 15 ft above the floor. Return air is taken back directly at the unit, thus eliminating any necessity for return ductwork.

Oil Vapors From Machine Cutting

Fog, caused by oil vapor from machine cutting operations, presented another problem. This condition is further aggravated with cooling, as the amount of outside air introduced into the conditioned area is much lower than with straight ventilation. For this reason, electrostatic type air cleaners were provided. These electrostatic filters not only remove the oil vapors but also 90 per cent of the airborne dust particles in the air stream. The filter consists of a high voltage power pack with a combined ionizing and dust collector cell. By passing the air (with the dust particles) through an ionizing section where a very strong electrostatic field is set up, the dust receives a positive electrical charge. As these charged particles pass between a series of plates negatively charged, the unlike charges are attracted and the dust particles are thrown against the plates. The plates are coated with a slight film of adhesive which holds the dust particles. Periodic washing of the plates is required to remove the dirt and a new film of adhesive must be applied.

The layout of the main air units is such that the return air, bypass air, minimum outside air, and maximum outside air must pass through the filters. There are chilled water coils of the finned type in a spray washer. A small recirculating pump sprays the water in the air stream and across the face of the coil thus assuring almost full saturation of the air leaving the washer. A standard arrangement of reheat coil, face, and bypass dampers is also provided. A spray water heater in the recirculating spray water system provides heat for winter control of dew point. The combined capacity of all supply fans is approximately 1,600,000 cfm, and 260,000 cfm of air is exhausted through fans from locker rooms, toilets, kitchens, processing, etc. Reliefs are also provided in the roof to permit the excess air to escape.



General view of the completely air conditioned office building. Two central system refrigeration systems are in the basement with separate zone control for the basement and three floors

Control Is Pneumatic

The temperature and humidity control system is of the pneumatic type. Three-way mixing and bypass valves are used in the hot water and chilled water circuits to insure constant flow conditions regardless of load requirements. The air leaving the washer is maintained at a constant dew point. In the summer, the dew point stat controls the amount of chilled water flowing through the coil and in mid-season the maximum outside air damper maintains the dew point if outside conditions permit the use of outside air for cooling. In winter, the dew point is maintained by controlling the temperature of the spray water. Dry bulb is maintained both in summer and winter by room thermostats operating bypass dampers and reheat coils in sequence.

Windowless Office Building

The office building is in itself a unique feature. Designed for maximum employee efficiency, the building is completely windowless and air conditioned. With a main corridor running the length of the building, offices are arranged on each side. Fluorescent lighting provides excellent illumination throughout with approximately 3½ watts per sq ft of floor area. Zoning for temperature control is provided for each floor with separate supply duct risers running from the basement equipment room. The main trunk duct is concealed above the corridor ceiling of each floor with side grille outlets supplying the air to the various rooms. Return air is allowed to pass from the rooms to the corridor through louvers in the doors, but because of the building construction it was possible to run a return riser to the upper floor only. On the lower floors, the air is returned to the basement through the main stairwell. There are provisions in the roof for relief to the atmosphere.

As mentioned previously, unitary direct expansion refrigeration systems are utilized for cooling. Two reciprocating type compressors are operated with separate refrigeration circuits in two washers enclosing fin type direct expansion coils. Evaporative type condensers provide the condensing medium.

Two main air units are used in which a constant dew point is maintained. Since two zones are operating from each unit, dry bulb temperatures are controlled by having a separate fan, bypass, and reheat coil for each zone. Electrostatic type air filters remove practically all dirt and dust from each system and a spray type washer, enclosing the cooling coils, insures saturation of the air leaving the washer. Control of humidity in the winter is accomplished by a hot water heater in the recirculating spray lines.

Constant Air Conditions 24 Hours a Day

Because of the high precision standards required, a separate group of rooms was provided in which the temperature and humidity are kept constant 24 hr a day for the maintenance of gages and master gages. Thus, it is possible to eliminate entirely even the slightest change in size of the gages and thereby maintain strict standards. Humidity, kept at 35 per cent, is low enough to prevent condensation on the highly polished surfaces of the gage blocks.

A direct expansion coil air unit operates in conjunction with a 20 hp reciprocating "Freon" compressor to provide cooling. An electric precipitation filter, reheat coil, and spray type humidifier are also provided. Pneumatic controls function through a thermostat to maintain 70 F in the conditioned space by operating either the compressor or reheat coil, depending upon load conditions. Similarly, the humidistat controls either the compressor or the humidifier for the maintenance of constant humidity.

Air distribution is through a system of supply ductwork with side outlet grilles. Return air is taken directly adjacent to all doors and windows opening into the space, thereby minimizing the adverse effect of temperature and moisture load entering the space when the doors and windows are open. Naturally, the doors and windows are normally closed and are open only for the passage of material and personnel.

An interesting feature of the installation is the test cell area where the engines are given a run-in test and operation is thoroughly checked. Engines leaving the plant must be in perfect condition, ready for immediate service.

Test Cell Area Is Interesting Feature

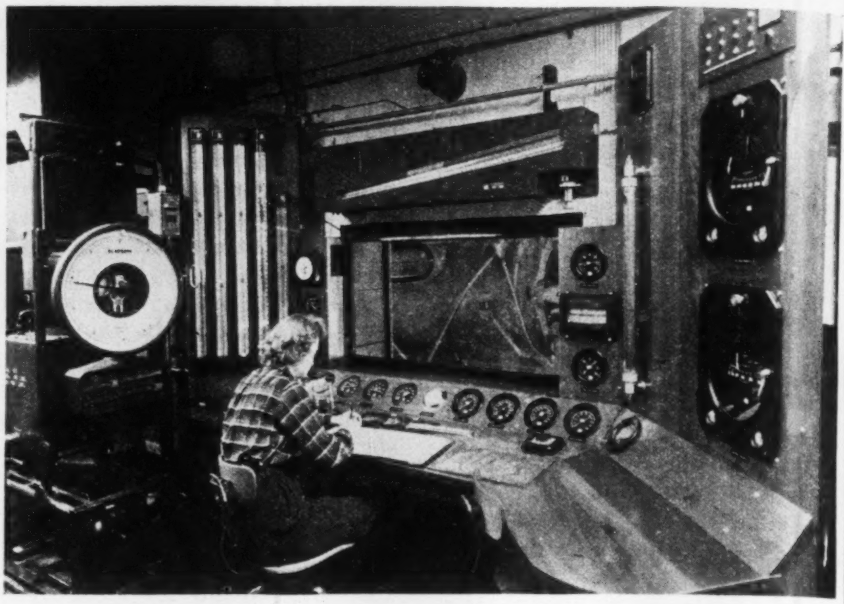
The main function of the mechanical equipment and the piping systems is to impose operating conditions of a pre-determined standard. For instance, the carburetor air is either cooled or heated to a constant fixed temperature; correction is made to the air pressure to compensate for low barometric and vapor pressure; and lubricating oil is cooled or heated to a fixed standard. In addition, gasoline and lubricating oil is pumped to each testing station from a remote storage point, thereby eliminating the necessity for any handling.

Details of the functions and methods of the testing obviously cannot be disclosed. However, it can be said that the design was such as to maintain the highest degree of accuracy, minimize loss of time, and simplify the routine to a point where semi-skilled operators only are required to run the test.

The control panel is arranged so that all instruments can be read and all controls worked from a single point, thus reducing fatigue of and strain on the operator. A novel gage checking feature is incorporated in the control panel, permitting the instantaneous checking and calibration of gages without removing them or disconnecting the piping. The control point is shielded from the engine by heavy reinforced concrete walls with double paneled glass observation windows. The noise of the engine is confined within the cell by taking the air in through a stack in which is built a labyrinth of small passages constructed of porous material which absorbs most of the sound.

The engine is mounted on a suspended cylinder, permitting rapid changing of engines. The method developed has considerably reduced this changeover time over previous methods thus permitting more efficient use of each stand.

Automatic controls are used throughout, thereby maintaining



General view of control panel. The operator views the engine on the other side of the concrete wall through double glass. Engine is operated completely from table

close and even conditions and assuring positive, accurate findings. The carburetor air is taken in through the roof, filtered, and either heated or cooled by a combination fin type coil which has a separate section for both 240 F hot water and 55 F chilled water, with each circuit controlled by a three-way water valve under the control of an indicating and adjustable thermostat. A separate water cooling system with reciprocating refrigeration compressors is provided to furnish the 55 F water, and the hot water is taken from the main hot water system. Air is delivered through round duct of 12 ga black iron built to withstand pressures as high as 25 in. H_2O; the entire duct system was hot dipped galvanized after fabrication to provide a clean inside surface that would not flake or rust. Welded construction with flanged and gasketed joints was used to insure the duct being absolutely airtight, which permits extremely accurate volume readings with the use of an orifice.

Oil Is Controlled and Salvaged

Oil temperature is maintained under thermostatic control by allowing the oil to flow either through an oil heater or an oil cooler. The oil heating is accomplished by the use of 240 F hot water in a shell and tube heat exchanger. The cooling is done in a similar heat exchanger but with the coolant a mixture of Prestone and water, which in turn is circulated and cooled in an evaporative type closed circuit coil cooler. Thus, it is possible to use outside air and evaporative cooling to eliminate the heat. The evaporative cooler itself has its own fan and spray circulating system. The Prestone mix is necessary in the coolant system to prevent freezing when outside temperatures are low.

Used oil is salvaged by reprocessing and filtering through the use of a complete system of piping, storage tanks, equipment, and pumps. New oil is also stored and is pumped to the various cells through piping. Sufficiently high oil temperature for pumping is maintained by running the oil lines together with the 240 F hot water system mains and insulating the pipes as one unit. This keeps the oil more fluid and results in lower pumping head without a material increase in the cost of the installation, as the hot water mains were already located and run for a different purpose. The oil system at the test stand itself consists of a series of tanks, valves, and circuits for preheating, flushing, circulating, measuring, etc.

Large quantities of gasoline are required to operate the tests and a system is provided to give maximum safety in the handling of this combustible fluid and yet provide any one of three types of gasoline instantaneously at the proper pressure. Gasoline is taken from storage tanks, pumped by a series of pumps into smaller pressure tanks, and distributed through underfloor trenches to the test stands.

Hot Water for Unit Heaters and Coils

Heating in the plant is provided almost entirely by the air handling system. Unit heaters, however, are installed for certain areas such as corridors, shipping platforms, etc., where there is no air handling equipment. Hot water at 240 F is circulated through all coils, unit heaters, and water heaters by centrifugal pumps. Hot water and steam is also used for a host of other purposes throughout the building for process work and other operations.

The water is heated by seven heat exchangers designed for 200 psi steam. Temperature is maintained by a thermostatic valve controlling the flow of steam. The steam is generated in the boiler house by seven 500 hp oil burning boilers, which were constructed completely assembled and tested at the factory. The burner is designed to use either commercial grade No. 6 or bunker C fuel oil and has a motor driven blower supplying secondary air. Boilers are of the four pass, downdraft design, complete with an integral channel iron frame and boiler assembly. The latest design is used on all auxiliary apparatus such as fuel oil pumps, feedwater pumps, injectors, preheaters, etc.

The entire plant, constructed in record time and under wartime conditions, was built for the Defense Plant Corp. Ford, Bacon & Davis, Inc., were the engineer-constructors and Kerby Saunders, Inc., was the mechanical installation contractor.

UNCLE SAM
WANTS YOU
TO FIGHT
FUEL WASTE!

SAM LEWIS' PAGE

By Samuel R. Lewis
Consulting Mechanical Engineer

Member of HPAC's Board
of Consulting & Contributing Editors

Steam Heating Systems With Overhead Returns

The fundamental physical consideration of steam heating is to provide steam in the heat transmitter, and not to try to do a heating job with air or condensate. The only historical excuse I can find for a steam heating system in which the condensate is trapped out of an overhead unit and forced up into a return main above the unit is that the owner was ignorant and the steamfitter was afraid and a trap manufacturer's agent needed to sell a trap.

There may be an occasional isolated old cast iron radiator in a steam heating system where the radiator ought to be below a return main but such cases are rare and such radiators, no matter how they are connected, tend to hammer and click and complain. The matter often can be solved by installing a small fan-equipped unit heater above the return main.

Most of us are familiar with a condensate lift assembly such as is used occasionally in a vacuum return main. It has a water trap at the bottom, similar to the trap on any lavatory bowl. The lift fitting in the lower return main fills with condensate and, eventually and intermittently, atmospheric pressure —or whatever pressure there may be in the lower main in excess of that in the higher main—causes the seal to give way and a piston like slug of water rises from the lower return main and flows out into the higher return main. Usually the gas which forces the water piston up is a mixture of steam and air. Such a device should be helpful when used on the return of each individual heat transmitter placed below a vacuum return main between the thermostatic trap and the main.

Suction lifts will work in vacuum return mains but they are not particularly desirable, because they depend on very exact pressure differentials. That is, if the steam pressure is too high on the inlet side of the lift the important water piston cannot form, but steam and water blow through continuously, and there will be no subatmospheric pressure on the return system; some of the heat transmitters will become water logged or air bound, and the designer will become unpopular. One leaking thermostatic trap or one weary vacuum pump or one small air leak into the return main between the suction lift and the vacuum pump can upset the whole scheme.

Informal

On this page, Mr. Lewis comments informally — at the request of the editors of HPAC—on a few of the problems he has met and is meeting in his wide experience as a consulting engineer engaged in heating, piping, and air conditioning work. Some of the time you'll agree with him . . . some of the time you may not . . . but you'll always find his remarks interesting and thought-provoking.

This month, he discusses the subject of steam heating systems with overhead returns to answer a question from a reader of this page.

Industrial heating systems in which there are many steam unit heaters are very common. A typical building is two stories high. The steam mains and the vacuum return mains are near the first story ceiling. Thus, the second story heat transmitters drain down, but the first story ones must drain upward. Such plants frequently have been designed and installed by the assistant plant operating engineer. The thermostatic return traps were obtained by the purchasing department which did not tell the trap salesman what they were for. The operating engineer admits that the second story heats very easily but that something terrible is wrong with the first story. He cannot get the air delivery hot enough, the thermostatic elements in the first story traps constantly have to be replaced, and the piping between the convectors of the unit heaters and the traps keeps "eating out" and leaking.

This assistant engineer has learned not to put steam heat transmitters below their drains. By doing so he has trapped some air and has heated this air in the presence of high temperature and moisture. Air under such conditions does a good job of destruction of ferrous metal as does water mixed with "Freon" refrigerant in contact with aluminum, or as does ammonia in contact with brass or copper.

The heat transmitters of a steam heating system should be above the return main. If the return main cannot, because of some physical condition, be below the heat transmitters, then change to forced circulation hot water, with which no such prejudice obtains.

Under the present copper shortage a great many ferrous metal steam heating convectors have been installed. Those which are installed with inferior venting and drainage will very quickly cry out for help. In most cases, the protective coating of such steel convectors is applied only to the exterior and there is no protection for the interior of the tubing.

* * *

EVERETT S. LEE HEADS ENGINEERS' COUNCIL

Everett S. Lee, engineer, general engineering laboratory, General Electric Co., has been elected chairman of the Engineers' Council for Professional Development. Serving with him are James W. Parker, vice-president and chief engineer of the Detroit Edison Co., vice-chairman; Stephen L. Tyler, executive secretary, American Institute of Chemical Engineers, secretary; and R. L. Sackett, dean emeritus of engineering, Pennsylvania State College, assistant secretary.

New Test Method Shows Efficiency of Kitchen Range Grease Filters

RANGE FILTERS are important parts of the ventilating systems of kitchens in industrial, commercial, institutional, and public buildings. They eliminate grease, dirty ducts, prevent dangerous fires in ventilating ducts, and protect exhaust fans and motors.

In order to study the efficiency of grease filters under various operating conditions, a test method and test apparatus have been designed.

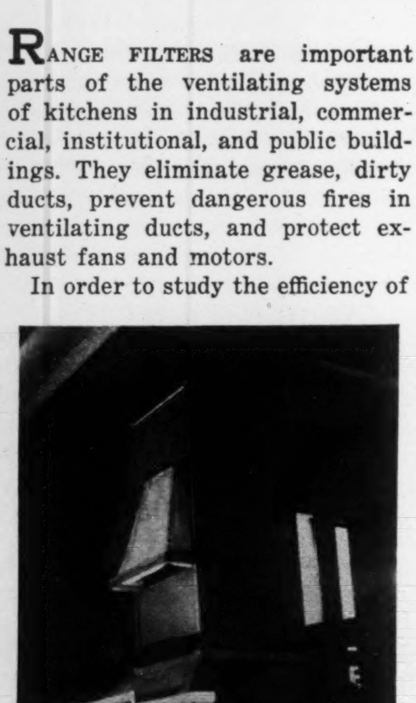


Fig. 1—The canopy, showing the grease filter and the absolute filter both protruding from the vertical duct

The Test Apparatus

The apparatus consists of a filter hood or canopy made of pressed fiber board as illustrated in Fig. 1. This filter hood consists of a 20 in. x 20 in. vertical duct with a flared opening at the bottom. At the junction of the flared opening and the duct is a shelf into which filters to be tested slide. One foot above the test filter is a shelf for the absolute filter, which is the shape of a truncated pyramid. The absolute filter is made of six ply crepe wadding, embossed.

The efficiency of the absolute filter is checked by placing a glass tube directly above it. This tube is connected to a Greenburg and Smith impinger outside of the duct. By means of a suction pump, air is drawn from the inside of the duct, bubbled through 75 cc of water in the impinger, and then passed through the orifice metering device. The grease fumes which may be in the air will condense in the water in the form of a very fine colloidal suspension. The air is drawn through the impinger for the duration of the test.

At the completion of the test, approximately 25 cc of carbon tetrachloride is shaken with the water. The grease settles out of suspension and partially dissolves in the carbon tetrachloride. The water is drawn off with a pipette. The carbon tetrachloride is then boiled off, leaving the grease which may have some dirt particles in it. The grease is accurately weighed on an analytical balance.

The ratio of the air passing through the filter as compared with the amount of air through the impinger makes it possible to determine the actual weight of grease passing through the absolute filter. Thus, the efficiency of the grease filter can be determined according to the following formula:

$$E_{GF} = \frac{W_{GF}}{W_{GF} + W_{AF} + W_1}$$

where E_{GF} = efficiency of grease filter, W_{GF} = weight of grease filtered by grease filter, W_{AF} = weight of grease filtered by absolute filter, and W_1 = weight of grease filtered by Greenburg and Smith impinger.

The duct with the flared bottom is supported by an open structure made of 2 in. x 4 in. wood. On the floor directly beneath the hood is a frying pan supported over a compressed air gas burner by means of bricks and a wire grate. A truncated cone of sheet metal is set on the frying pan to return spattered grease to the frying pan. Figs. 2 and 3 show the source of grease fumes.

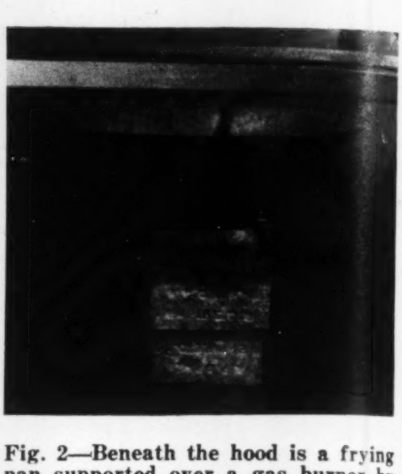


Fig. 2—Beneath the hood is a frying pan supported over a gas burner by means of bricks and a wire grate

Fig. 4 illustrates the entire test setup. The top of the vertical duct is connected to a 9 in. diameter pipe which in turn is connected to a blower. The air flow is regulated by the blast damper. Static pressure gages are employed as shown. There is a water pan on the side of the apparatus with a copper tube protruding from the bottom and terminating at a point directly over the frying pan. A stop cock in the line regulates the rate of flow into the frying pan. In order to check the operating temperature, thermometers are placed directly below the grease filter.

The Test Procedure

The grease filter and absolute filter are weighed and placed in their proper places in the unit. The absolute filter is placed in an oven at 85 C for 1 hr before weighing to obtain the weight in the moisture free condition. Scotch tape is placed over all joints of the

M. H. Kliefoth and D. L. Hunzicker Describe Setup and Procedure for Determining Effectiveness of Air Filters Used for Cleaning Greasy Exhaust from Kitchen Range Canopies and Hoods

grease filter and absolute filter panel doors to insure against leakage. The air flow is regulated to 200 fpm through the grease filter by adjusting the damper. The resistance of the grease filter is noted at the beginning and end of the test by reading the manometer gage connected to the static pressure tap on the exhaust side of the filter.

The gas burner is turned on and adjusted so that the temperature directly below the filter as indicated by the thermometer is correct as predetermined for the test.

One-half pound of lard is placed in the frying pan and the water is regulated to cause the grease to spatter and vaporize. The grease fumes are drawn up and condensed or impinged on the grease filter. The grease fumes passing through the grease filter are caught by the absolute filter. The amount of grease fumes passing through the absolute filter is very small, but these grease fumes are measured by the condensing scheme described above.

After all the grease is out of the pan, the burner is turned off and the air is allowed to flow through the unit at room temperature for approximately 10 min to allow the absolute and grease filters to become normalized to room temperature. The two filters are removed and the absolute filter is placed in an oven at 85 C for 1 hr before weighing, whereas the grease filter is weighed immediately. The method of calculating the efficiency has been described. The ½ lb of lard placed in the pan is not considered in the calculation because some of the grease spatters in big droplets and falls on the floor. In order to test air filters operating at various temperatures the apparatus can be raised or lowered over the stationary frying pan or the apparatus can be stationary and the frying pan and heating element can be arranged so that the distance between the frying pan and filter surface can be varied according to a predetermined program.

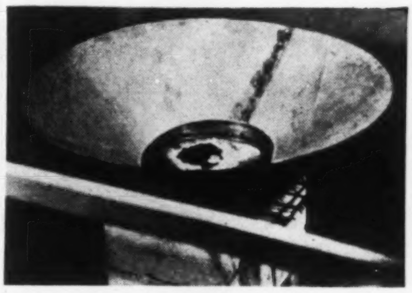


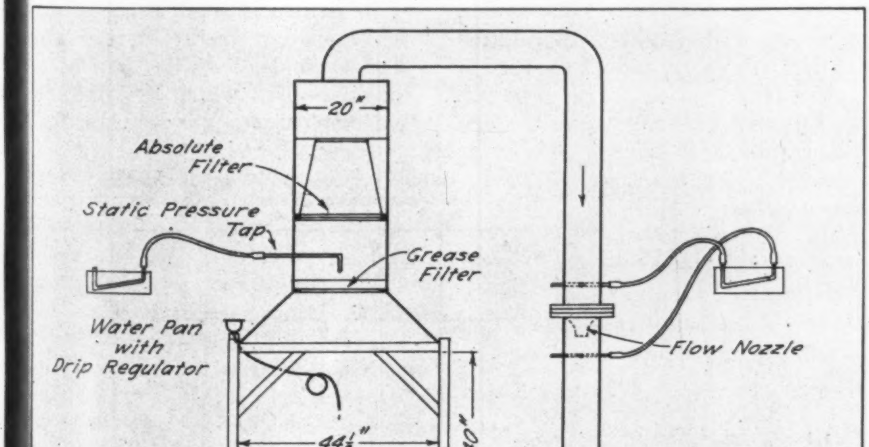
Fig. 3—A sheet metal cone returns spattered grease to the frying pan

Dust Removal Efficiency

The literature was closely studied but it was found that no method for testing grease filter performance was described. It is obvious that this grease filter test can be combined with a dust filtration test by merely introducing a given amount of a standard dust and separating such dust from the grease after making an overall dust-grease efficiency calculation. It is thus possible to determine not only the efficiency of a grease filter with respect to recovering grease particles but also to get data on the dust removal efficiency of such filters under simulated conditions of grease filter installations.

[Acknowledgment is made to the helpful suggestions of Prof. Frank B. Rowley, director of the Engineering Experiment Station at the University of Minnesota.]

Fig. 4—The complete grease filter test setup



BRITISH IMPROVE FIREPLACES

Much of the heating in British homes is still done by open coal fires. There is also a strong body of opinion that this will continue to be true after the war in spite of the obvious advantages that Americans see in furnaces or other central heating plants for domestic comfort heating. This viewpoint, as well as the need for saving coal, has resulted in intensive experimentation to increase the heating efficiency of the fireplace.

Units have been developed in which air circulates around the brickwork to carry heat into the room. A register has been designed and tested which helps to secure rapid increase in combustion and then to hold it at the desired rate.—W. C. Schroeder, at annual meeting of ASME.

Fat Salvage . . .

. . . is not the reason for filtering the air exhausted from large kitchens. Kitchen range filters are important parts of ventilating systems for they eliminate greasy, dirty ducts, prevent dangerous fires in such ducts, and protect exhaust fans and motors.

How efficient is a filter for grease removal? The authors—both of the Research Products Corp.—searched the literature, but could find no test method to determine this important point. They therefore developed the test setup and procedure described here.

MEASURING the FLOW of FLUIDS

William Goodman gives practical data on use of orifices and manometers for measuring fluid flow in pipe lines in group of articles of which this is the fifth, describing orifice installation

SOME OF those who find it necessary to meter the flow of fluids may find it difficult on occasion to obtain manometers and orifices. As a consequence of the war, even those with fairly high priorities sometimes may be forced to wait for a considerable period for the delivery of equipment; those whose priority numbers are low or who have no right to obtain a priority at all may find it virtually impossible to obtain equipment. The instructions in this article may offer a solution to such difficulties; they also serve to indicate some of the considerations involved in the design and construction of commercially-available flow measuring equipment.

Orifice Construction

The construction of a satisfactory orifice is illustrated in Fig. 6. The various dimensions corresponding to this illustration are given in Table 7. The dimension D is, of course, the throat diameter of the orifice selected by means of Table 1, on p. 462 of the September HPAC. The outside diameter of the orifice, D_0, listed in Table 7, is the correct size to fit inside the bolt circle of 125 psi standard companion flanges or of 150 psi standard steel welding neck flanges.

Although orifices can be constructed of steel, nonrusting metals such as brass, bronze, monel, or stainless steel are preferable. The thickness of the edge of the orifice, b, of Fig. 6 may be found in Table 7. Although the thickness may be less than the dimension shown in Table 7, it should not be greater. The upstream edge of the orifice should be sharp and square; not rounded. Needless to say, the edges should be free from burrs.

After the orifice is finished, it is a wise plan to file a "V" or an arrow on the rim to indicate the direction of flow through the orifice. This elementary precaution may sometimes avoid a great deal of trouble and annoyance after the orifice is installed in the pipe line.

Pressure Taps

The three types of pressure taps for which data are given in this article are flange taps, vena contracta taps, and radius taps. The location of flange taps in relation to the orifice is shown in Fig. 7. The distance of both the upstream and downstream taps from the orifice plate are always constant and equal to the values shown in Fig. 7 regardless of the size of the orifice or the pipe.

The location of radius taps and vena contracta taps in relation to the orifice plate are shown diagrammatically in Fig. 8. The dimensions for the upstream and downstream taps for radius taps are given in Table 8. For radius taps, these dimensions are independent of the size of the orifice and depend only upon the size of the pipe.

For vena contracta taps, the dimension L_U for the upstream taps is the same as for radius taps. Hence, for vena contracta taps, the dimension L_U may also be obtained from Table 8. On the other hand, the dimension L_D of the downstream tap for vena contracta taps depends upon both the pipe size and the orifice diameter. The dimension L_D of Fig. 8 for vena contracta taps is given in Table 9. Knowing both the diameter of the pipe and of the orifice, the dimension L_D of Fig. 8 can be obtained from Table 9.

Flange taps are usually used in manufactured orifices which are supplied with the special flanges needed. For the user who must make and install his own orifice and manometer, flange taps are inconvenient. The usual flanges are not thick enough to permit a hole to be drilled through them and still leave enough metal on the edge. For example, 8 in. is the smallest size pipe for which standard 125 psi companion flanges are thick

Fig. 6—Orifice plate. For dimensions, see Table 7

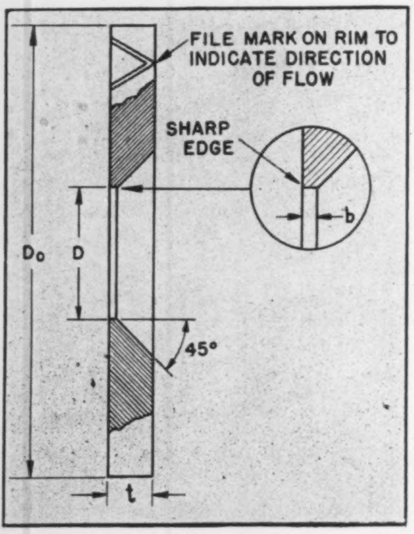


Table 7—Orifice dimensions for installation in 125 psi companion flanges. See Fig. 6

Nominal Pipe Size Inches	Outside Diameter Inches D_0	Thickness Inches t	Maximum Thickness of Orifice Edge Inches b
2	4	1/8	0.04
2-1/2	4-3/4	1/8	.05
3	5-1/4	1/8	.06
4	6-3/4	1/8	.08
5	7-5/8	1/8	.10
6	8-5/8	1/8	.12
8	10-7/8	1/4	16
10	13-1/4	1/4	.20
12	16	1/4	.24

Copyright 1943 by William Goodman. The author is consulting engineer, the Trane Co., and a member of HPAC's board of consulting & contributing editors.

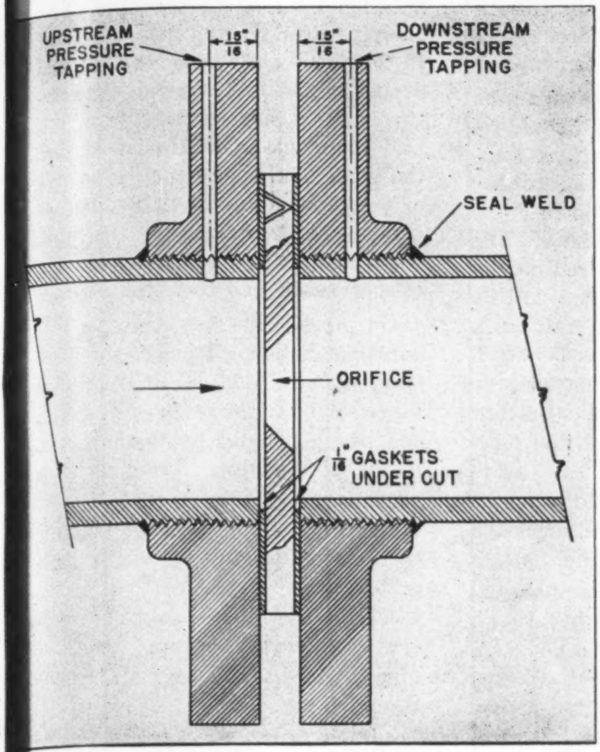


Fig. 7—Location of flange taps

Table 9—Location of downstream taps for vena contracta taps. Dimension L_D of Fig. 8 in inches. Upstream tap dimension L_U is same as for radius taps in Table 8

Orifice Diameter Inches D		Nominal Pipe Size — Inches								
		2	2-1/2	3	4	5	6	8	10	12
5/8	0.625	1.59								
3/4	0.750	1.52	1.91							
7/8	0.875	1.43	1.84							
1	1.000	1.33	1.76	2.35						
1-1/8	1.125	1.21	1.66	2.28						
1-1/4	1.250	1.08	1.55	2.19	3.14					
1-3/8	1.375	0.95	1.43	2.09	3.07					
1-1/2	1.500		1.30	1.99	2.99					
1-5/8	1.625		1.17	1.88	2.91	3.92				
1-3/4	1.750			1.75	2.81	3.85				
1-7/8	1.875			1.62	2.71	3.77	4.77			
2	2.000			1.48	2.60	3.69	4.70			
2-1/8	2.125			1.35	2.49	3.60	4.63			
2-1/4	2.250				2.37	3.49	4.55			
2-3/8	2.375				2.24	3.39	4.46			
2-1/2	2.500				2.10	3.28	4.38	6.36		
2-5/8	2.625				1.97	3.17	4.27	6.30		
2-3/4	2.750				1.83	3.05	4.18	6.23		
2-7/8	2.875					2.92	4.07	6.15		
3	3.000					2.79	3.96	6.07		
3-1/4	3.250					2.53	3.73	5.89	8.01	
3-1/2	3.500						3.48	5.71	7.87	
3-3/4	3.750						3.22	5.50	7.71	9.56
4	4.000						2.95	5.29	7.54	9.43
4-1/4	4.250							5.05	7.36	9.28
4-1/2	4.500							4.81	7.15	9.13
4-3/4	4.750							4.55	6.95	8.94
5	5.000							4.29	6.74	8.76
5-1/2	5.500							3.76	6.28	8.36
6	6.000								5.77	7.95
6-1/2	6.500								5.24	7.48
7	7.000								4.69	6.99
7-1/2	7.500									6.45
8	8.000									5.91
8-1/2	8.500									5.34

Note: Dimensions in this table based on orifice plate being installed with 1/16-in. thick gaskets.

enough to permit drilling a 1/8 in. hole and still leave 1/8 in. metal between the edge of the hole and the outside face of the flange. For 250 psi flanges, 4 in. is the smallest size pipe for which the flanges are thick enough to leave 3/16 in. between the edge of the 1/8 in. hole and the outside face of the flange. Because of the special flanges required for flange taps, it is probable that either vena contracta or radius taps are the most practical for those who must make their own orifices.

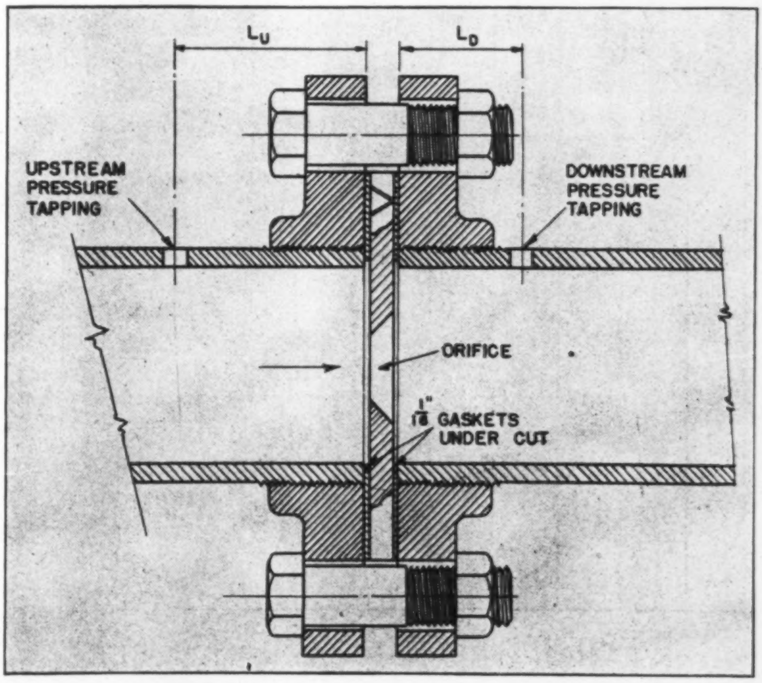
Table 8—Location of radius taps. See Fig. 8

Nominal Pipe Size Inches	Upstream Tapping Inches	Downstream Tapping Inches
	L_U	L_D
2	2.00	0.97
2-1/2	2.41	1.17
3	3.01	1.47
4	3.96	1.95
5	4.98	2.46
6	6.00	2.97
8	8.01	3.97
10	10.07	5.01
12	12.03	5.98

Note: Dimensions in this table based on orifice plate being installed between 1/16 in. thick gaskets.

The upstream pressure tap of both vena contracta and radius taps will clear the hubs of 125 psi standard flanges. On the other hand, in the smaller pipe sizes the **downstream tap** for radius and vena contracta taps will frequently not clear the hub of the flange. For convenience in checking this point, the overall thicknesses of 125 psi companion flanges are listed in Table 10. Comparing the dimensions in Table 10 with those in Table 8, it is obvious that for 2, 2½, and 3 in. pipe the downstream tap of radius

Fig. 8—Location of vena contracta and radius taps. Dimension L_U for both radius and vena contracta taps is given in Table 8. For radius taps, the dimension L_D is also given in Table 8. For vena contracta taps, the dimension L_D is given in Table 9



taps would lie partially underneath the hub of the flange. Consequently, when using radius taps in pipes of these sizes, it is better to use welding neck companion flanges. In such flanges, the pressure tap can be drilled directly through the neck of the flange.

In the small pipe sizes, the downstream tap of vena contracta taps also may not clear the hub of the flange. By comparing the dimensions shown in Table 9 with those in Table 10, the user can readily determine whether or not standard screwed companion flanges may be used or whether a welding neck flange is required in order to accommodate the downstream tap.

Table 10—Thickness of screwed companion flanges, 125 psi cast iron

Nominal Pipe Size	Over-All Dimension from Face to Hub
2 in.	1.00 in.
2½	1.14
3	1.20
4	1.30
5	1.41
6	1.51
8	1.71
10	1.93
12	2.13

The location of the pressure taps is critical and great care should be exercised in drilling them as accurately as possible in accordance with the dimensions shown in Figs. 7 and 8, and Tables 8 and 9. The dimensions shown are based on the assumption that the orifice will be installed between 1/16 in. thick gaskets as shown in Figs. 7 and 8.

Pressure taps in horizontal pipe lines should not be installed either at the top or the bottom of the pipe. The proper location for the tap is through the side of the pipe as shown in Fig. 9. Top connections may become airbound and bottom connections may become plugged with dirt. The pressure tap through the wall of the pipe should be ¼ in. in diameter or smaller—⅛ in. taps are also satisfactory, although they are more likely to become plugged. Inside the pipe the edge of the tap hole should be free from burrs and slightly rounded.

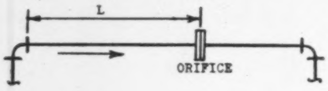
A good method of making tubing connections to pressure taps in the pipe is to weld a ¼ in. pipe nipple about 6 in. long to the outside of the pipe over the tap hole as shown in Fig. 9. Only one end of the nipple should be threaded. The unthreaded end should be filed with a half-round file to fit the contour of the pipe. The hole through the wall of the pipe should be drilled before the nipple is welded to the pipe. Flare couplings are used to connect copper tubing to the pipe nipples.

On pipes 8 in. and larger, a hole can be drilled through the pipe wall, tapped, and a ⅛ in. nipple screwed into the pipe. However, the nipple should be flush on the inside of the pipe. Avoid either a projection or a recess on the inside of the pipe. To make sure that the threaded end is cut off at the right point so that it will be flush on the inside of the pipe, it is well first to try the nipple in a short length of pipe where the length of the threaded end can be checked easily.

Orifice Installation

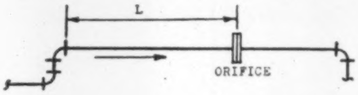
An orifice will not give accurate results unless it is preceded and followed by a length of straight pipe without any joints. The minimum lengths of pipe that are re-

Table 11—Minimum straight length of pipe required on upstream side of orifice



Orifice Diameter Inches	Nominal Pipe Size — Inches 2	2-1/2	3	4	5	6	8	10	12
5/8	1'-0"								
3/4	1 -0	1'- 3"							
7/8	1 -1	1 - 3							
1	1'-2"	1'- 3"	1'- 6"						
1-1/8	1 -4	1 - 4	1 - 6						
1-1/4	1 -7	1 - 5	1 - 7	2'- 0"					
1-3/8	2 -0	1 - 8	1 - 7	2 - 0					
1-1/2		1'-11"	1'- 9"	2'- 0"	2'- 6"				
1-5/8		2 - 5	1 -10	2 - 0	2 - 6				
1-3/4		2 -11	2 - 1	2 - 1	2 - 6				
1-7/8			2 - 4	2 - 2	2 - 6				
2			2'-10"	2'- 4"	2'- 6"	3'- 0"			
2-1/8			3 - 4	2 - 5	2 - 7	3 - 0			
2-1/4				2 - 9	2 - 8	3 - 0			
2-3/8				2 -11	2 -10	3 - 0			
2-1/2				3'- 3"	2'-11"	3'- 1"	4'- 0"		
2-5/8				3 - 9	3 - 0	3 - 2	4 - 0		
2-3/4				4 - 3	3 - 2	3 - 3	4 - 0		
2-7/8					3 - 5	3 - 4	4 - 0		
3					3'- 7"	3'- 6"	4'- 0"	5'-1"	
3-1/4					4 - 5	3 -10	4 - 0	5 -1	
3-1/2					5 - 6	4 - 3	4 - 2	5 -1	
3-3/4						5 - 0	4 - 4	5 -1	6'- 1"
4						5'-10"	4'- 8"	5'-1"	6'- 1"
4-1/4						6 -10	4 -11	5 -2	6 - 1
4-1/2							5 - 5	5 -4	6 - 1
4-3/4							5 - 9	5 -6	6 - 1
5							6'- 8"	5'-8"	6'- 2"
5-1/2							8 - 6	6 -4	6 - 5
6								7 -4	6 -11
6-1/2								9 -1	7 - 7
7								11'-2"	8'- 6"
7-1/2									10 - 0
8									11 - 9
8-1/2									13 - 8

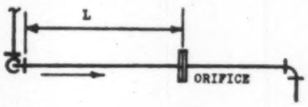
Table 12—Minimum straight length of pipe required on upstream side of orifice



Orifice Diameter Inches	Nominal Pipe Size — Inches 2	2-1/2	3	4	5	6	8	10	12
5/8	1'- 6"								
3/4	1 - 6	1'- 9"							
7/8	1 - 6	1 - 9							
1	1'- 8"	1'- 9"	2'- 2"						
1-1/8	1 -11	1 -11	2 - 2						
1-1/4	2 - 4	2 - 2	2 - 2	2'-11"					
1-3/8	2 -10	2 - 5	2 - 4	2 -11					
1-1/2		2'-11"	2'- 6"	2'-11"	3'- 7"				
1-5/8		3 - 4	2 -10	2 -11	3 - 7				
1-3/4		3 -11	3 - 2	3 - 0	3 - 7				
1-7/8			3 - 7	3 - 2	3 - 7				
2			4'- 1"	3'- 4"	3'- 7"	4'-4"			
2-1/8			4 - 7	3 - 8	3 - 8	4 -4			
2-1/4				4 - 0	3 -10	4 -4			
2-3/8				4 - 4	3 -11	4 -4			
2-1/2				4'-10"	4'- 2"	4'-4"	5'- 9"		
2-5/8				5 - 4	4 - 6	4 -5	5 - 9		
2-3/4				5 -10	4 - 8	4 -7	5 - 9		
2-7/8					5 - 2	4 -9	5 - 9		
3					5'- 6"	5'-1"	5'- 9"	7'- 4"	
3-1/4					6 - 4	5 -8	5 - 9	7 - 4	
3-1/2					7 - 7	6 -5	5 -11	7 - 4	
3-3/4						7 -3	6 - 3	7 - 4	8'- 8"
4						8'-3"	6'- 9"	7'- 4"	8'- 8"
4-1/4						9 -3	7 - 5	7 - 5	8 - 8
4-1/2							8 - 1	7 - 7	8 - 8
4-3/4							8 - 9	8 - 0	8 - 8
5							9'- 8"	8'- 5"	8'- 9"
5-1/2							11 - 9	9 - 6	9 - 4
6								11 - 0	10 - 1
6-1/2								12 -10	11 - 3
7								15'- 2"	12'-10"
7-1/2									14 - 6
8									16 - 6
8-1/2									18 - 5

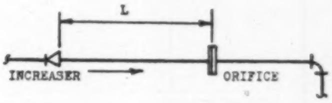
Note: If a double elbow is also used on the downstream side of the orifice, the downstream pipe length shall be made equal to the upstream length.

Table 13—Minimum straight length of pipe required on upstream side of orifice



Orifice Diameter Inches	2	2-1/2	3	4	5	6	8	10	12
	Nominal Pipe Size — Inches								
5/8	2'- 9"								
3/4	2 -11	3'-4"							
7/8	3 - 2	3 -6							
1	3'- 5"	3'-8"	4'- 3"						
1-1/8	3 - 9	4 -0	4 - 5						
1-1/4	4 - 3	4 -3	4 - 8	5'- 5"					
1-3/8	4 -10	4 -8	4 -10	5 - 7					
1-1/2		5'-2"	5'- 1"	5'-10"	6'- 9"				
1-5/8		5 -9	5 - 6	6 - 0	6 -11				
1-3/4		6 -6	5 -11	6 - 4	7 - 1				
1-7/8			6 - 5	6 - 7	7 - 3				
2			7'- 0"	6'-10"	7'- 7"	8'- 4"			
2-1/8			7 - 8	7 - 3	7 - 9	8 - 6			
2-1/4				7 - 7	8 - 0	8 - 9			
2-3/8				8 - 1	8 - 2	9 - 0			
2-1/2				8'- 7"	8'- 7"	9'- 2"	10'-10"		
2-5/8				9 - 2	8 -10	9 - 5	11 - 0		
2-3/4				9 -11	9 - 3	9 - 7	11 - 3		
2-7/8					9 - 8	9 -10	11 - 6		
3					10'- 1"	10'- 4"	11'- 8"	13'- 6"	
3-1/4					11 - 3	11 - 1	12 - 1	13 -11	
3-1/2					12 - 8	11 -11	12 - 6	14 - 2	
3-3/4						12 -11	13 - 0	14 - 8	16'- 3"
4						14'- 2"	13'- 9"	15'- 1"	16'- 7"
4-1/4						15 - 7	14 - 6	15 - 8	17 - 0
4-1/2							15 - 3	16 - 1	17 - 5
4-3/4							16 - 2	16 - 7	17 -11
5							17'- 3"	17'- 0"	18'- 4"
5-1/2							19 -10	18 - 8	19 - 5
6								20 - 5	20 - 7
6-1/2								22 - 8	22 - 2
7								25'- 7"	23'- 9"
7-1/2									25 -10
8									28 - 3
8-1/2									31 - 2

Table 14—Minimum straight length of pipe required on upstream side of orifice



Orifice Diameter Inches	2	2-1/2	3	4	5	6	8	10	12
	Nominal Pipe Size — Inches								
5/8	1'-0"								
3/4	1 -0	1'-3"							
7/8	1 -1	1 -3							
1	1'-3"	1'-3"	1'- 6"						
1-1/8	1 -5	1 -5	1 - 6						
1-1/4	1 -8	1 -7	1 - 7	2'- 0"					
1-3/8	1 -11	1 -9	1 - 9	2 - 0					
1-1/2		2'-1"	1'-11"	2'- 0"	2'- 6"				
1-5/8		2 -3	2 - 1	2 - 1	2 - 6				
1-3/4		2 -7	2 - 4	2 - 2	2 - 6				
1-7/8			2 - 7	2 - 4	2 - 6				
2			2'- 9"	2'- 6"	2'- 7"	3'-0"			
2-1/8			3 - 1	2 - 8	2 - 8	3 -0			
2-1/4				2 -11	2 -10	3 -0			
2-3/8				3 - 2	2 -11	3 -1			
2-1/2				3'- 5"	3'- 2"	3'-2"	4'- 0"		
2-5/8				3 - 7	3 - 4	3 -3	4 - 0		
2-3/4				3 -11	3 - 5	3 -5	4 - 0		
2-7/8					3 - 9	3 -6	4 - 0		
3					3'-11"	3'-9"	4'- 0"	5'- 1"	
3-1/4					4 - 5	4 -2	4 - 1	5 - 1	
3-1/2					5 - 0	4 -7	4 - 4	5 - 1	
3-3/4						5 -1	4 - 8	5 - 1	6'- 1"
4						5'-7"	5'- 1"	5'- 2"	6'- 1"
4-1/4						6 -1	5 - 5	5 - 4	6 - 1
4-1/2							5 -10	5 - 6	6 - 1
4-3/4							6 - 4	5 -11	6 - 2
5							6'-10"	6'- 3"	6'- 4"
5-1/2							7 -10	7 - 0	6 -11
6								8 - 0	7 - 7
6-1/2								9 - 0	8 - 3
7								10'- 1"	9'- 2"
7-1/2									10 - 2
8									11 - 1
8-1/2									12 - 2

quired ahead of an orifice with different pipe fittings may be found in Tables 11 to 15 inclusive. Thus, if two elbows in the same plane precede a 2 in. orifice in a 3 in. pipe, Table 12 shows that a 4 ft 1 in. length of straight pipe is required ahead of the orifice. Notice that two elbows ahead of an orifice as in Table 12 require a greater length of pipe than is required for the single elbow listed in Table 11. The reason for this is that the two elbows produce a greater disturbance in the flow and consequently a greater length of pipe is required before a normal flow pattern is re-established within the pipe.

The lengths of pipe required when valves precede the orifice are shown in Table 15. This table may be used for either gate valves or globe valves. Wherever possible, it is best to avoid installing valves ahead of the orifice; valves should preferably be installed on the downstream side. When gate valves are installed ahead of an orifice, they must be wide open at all times.

Only the more common fitting arrangements are shown in Tables 11 to 15. The pipe lengths required for fittings not shown may be approximated from these tables. For example, the length of straight pipe required when a tee precedes the orifice is about the same as for an elbow.

The length of straight pipe required after an orifice is shown in Table 16. Although an elbow is shown following the orifice in the illustration at the top of Table 16, the pipe lengths shown in this table may also be used if a tee or a valve follows the orifice. The downstream lengths of pipe shown in Table 16 are suitable where the direction of flow is changed only once. In some installations, the orifice is followed by a double elbow similar to the double elbow shown ahead of the orifice illustrated in Table 12. If the orifice is followed by a double elbow, the downstream length of pipe should be equal to the upstream length shown in Table 12.

When making up a pair of companion flanges for an orifice, the pipe should be screwed into the flange until it is flush with the face of the flange. The hole in the gasket should have a diameter slightly greater than the inside diameter of the pipe so that if the gasket is not centered exactly, it will in no case project beyond the pipe wall. Fig. 8 shows the way the pipe, gasket, and orifice should fit together. The edge of the pipe is flush with the face of the flange and touches the gasket.

The piping system should be checked to be sure that the orifice

Fig. 9—Pressure taps should be drilled through side of pipe, not through the top or bottom. Top connections may become airbound, and bottom connections may become plugged with dirt

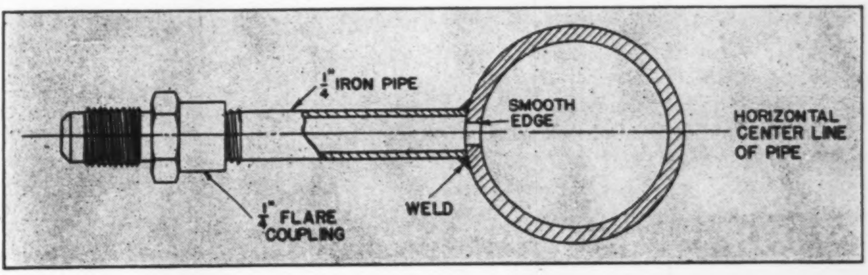
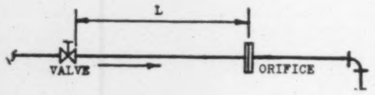


Table 15—Minimum straight length of pipe required on upstream side of orifice

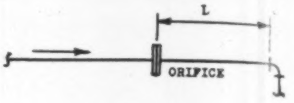


Orifice Diameter Inches	Nominal Pipe Size — Inches								
	2	2-1/2	3	4	5	6	8	10	12
5/8	3'- 4"								
3/4	3 - 7	4'- 0"							
7/8	3 -10	4 - 2							
1	4'- 2"	4'- 6"	5'- 1"						
1-1/8	4 - 6	4 - 9	5 - 4						
1-1/4	5 - 2	5 - 2	5 - 8	6'- 6"					
1-3/8	6 - 0	5 - 7	5 -11	6 -10					
1-1/2		6'- 4"	6'- 3"	7'- 0"	8'- 1"				
1-5/8		7 - 1	6 - 8	7 - 3	8 - 4				
1-3/4		8 - 2	7 - 2	7 - 8	8 - 7				
1-7/8			7 -10	7 -11	8 - 9				
2			8'- 7"	8'- 4"	9'- 4"	10'- 1"			
2-1/8			9 - 7	8 - 9	9 - 6	10 - 4			
2-1/4				9 - 3	9 -10	10 - 7			
2-3/8				9 -10	10 - 0	10 - 9			
2-1/2				10'- 6"	10'- 5"	11'- 1"	13'- 1"		
2-5/8				11 - 4	10 - 9	11 - 4	13 - 5		
2-3/4				12 - 3	11 - 1	11 - 8	13 - 8		
2-7/8					11 - 9	11 -11	13 -11		
3					12'- 3"	12'- 6"	14'- 1"	16'- 2"	
3-1/4					13 -10	13 - 4	14 - 7	16 -11	
3-1/2					15 - 9	14 - 6	15 - 2	17 - 3	
3-3/4						15 -10	15 - 8	17 - 9	19'-8"
4						17'- 6"	16'- 8"	18'- 2"	20'-2"
4-1/4						19 - 6	17 - 6	18 -10	20 -8
4-1/2							18 - 4	19 - 4	21 -1
4-3/4							19 - 8	20 - 0	21 -6
5							21'- 1"	20'- 9"	22'-2"
5-1/2							24 - 7	22 - 4	23 -6
6								24 -10	25 -0
6-1/2								28 - 0	26 -6
7								31'-10"	28'-10"
7-1/2									31 -5
8									35 -0
8-1/2									38 -9

will not act as a dam and hold up water when the piping system is drained. If there is any possibility of the orifice acting as a dam, drain connections should be provided on both sides of the orifice. However, the drain connections should not be near the orifice; they should be installed beyond the lengths of straight pipe specified in Tables 11 to 16 inclusive.

Be sure when installing the orifice between the flanges that the mark on the rim points in the same direction as the flow.

Table 16—Minimum straight length of pipe required on downstream side of orifice. If a double elbow is used on downstream side of orifice, the downstream pipe lengths should be equal to the upstream lengths shown in Table 12



Nominal Pipe Size Inches	Pipe Length L_D
2	0'-10"
2-1/2	1 - 0
3	1 - 3
4	1 - 8
5	2 - 1
6	2 - 6
8	3 - 4
10	4 - 3
12	5 - 0

[*This is the fifth of a series of articles on Measuring the Flow of Fluids, earlier installments having appeared in the August, September, October, and November issues.*]

Requirements for Instrument Piping and Castings To Be Added to Pressure Piping Code

As a result of the recommendations of the subcommittee on scope and intent of the sectional committee on the Code for Pressure Piping, two new special subcommittees are being appointed. One of these will formulate requirements for instrument piping and the other will develop quality factors for castings and working stresses for steel castings, forgings, plate, and bars, all for inclusion in the American Standard Code for Pressure Piping, ASA B31.1-1942.

It has been recognized for some time that present code requirements and standards for instrument piping are not sufficiently complete to provide adequate assurance of the safety of such piping systems, according to the committee. The new subcommittee to handle this assignment will consist of members of the sectional committee selected from the subcommittees that developed each section of the code representing the several types of piping, together with representatives of manufacturers.

The second subcommittee is being formed in accordance with a recommendation made by the recently appointed joint conference committee on piping codes and standards, and endorsed by the subcommittee on scope and intent. This subcommittee's assignment will consist of two parts: The formulation of working stresses for steel castings, forgings, plate, and bars for use in designing special fittings, which are not intended for application, however, to existing standard designs; and the development of rules for casting quality factors which will be applicable only to design of special castings.

Both of these subcommittees will be asked to develop their recommendations in the form of rules and tables similar to like data contained in the ASME Boiler Construction Code.

No Natural Gas for New Residential Heating in D. C.

Delivery of natural gas for space heating to residential customers in the District of Columbia not already receiving service was prohibited by the War Production Board November 17. The action was taken in a revision of order U-7 by adding the District to the critical gas areas listed in the order. The only other additions were a few scattered counties in states already affected.

Under the order, gas can be delivered for space heating to District consumers who were using it for that purpose on premises where equipment had been installed prior to December 2, 1942; or in the case of new construction, if gas equipment was installed prior to March 1, 1943. Delivery of gas also may be authorized by the WPB.

The DRYING of FOODS

W. R. Marshall Jr. Describes and Analyzes Operation of Tunnel Type Food Dryers to Show the Material and Heat Exchanges in Various Modifications of This Equipment

Current literature frequently conveys the impression that the tunnel type dryer is the most important kind for food drying operations. Although such is not the case — because great quantities of food are being dried in spray dryers, rotary dryers, drum dryers, and through-circulation dryers — nevertheless it is true that for fruits and many vegetables the tunnel type dryer predominates.

In essence, a tunnel dryer is a means for contacting, continuously, a stream of wet food with a stream of hot air. As the food and air move through the tunnel there is a change in their physical and thermodynamic properties along the length of the dryer; i.e., the food changes in moisture content and rises in temperature, and the humidity and temperature of the air change. Definite mathematical relationships exist between these air and food changes.

Classification of Tunnel Dryers

The various kinds of tunnel dryers differ primarily with respect to the direction of air flow, and on this basis the following classification can be made:

- Tunnel dryers operating adiabatically with countercurrent air flow; i.e., the food moves in a direction opposed to the direction of air flow.
- Tunnel dryers operating adiabatically with parallel air flow; i.e., air and food travel in the same direction.
- Tunnel dryers operating adiabatically with parallel and countercurrent flow in combination. This type has been designated as the center exhaust tunnel dryer.
- Non-adiabatic operation with either countercurrent or parallel flow.

The operation of a tunnel dryer generally concerns the temperature, quantity, and moisture-holding capacity of the circulated air. The size of a tunnel is a function of the drying characteristics and quantity of the material being dried. Drying is accomplished by virtue of the fact that heat is transferred from the air stream to the material, and the heat so transferred is used to evaporate the water contained by the food. After evaporation the water must then pass into the air stream to be carried out of the tunnel. It is apparent, then, that the process may be analyzed on the basis of heat transfer or mass transfer. The analysis of drying problems on the basis of heat transfer is becoming more important as research indicates that the measurement of heat transfer coefficients can be made more precisely than measurements of mass transfer coefficients. In applying present fundamental concepts of drying to the drying of foods, however, the properties of the food (i.e., the properties of the solid stream) are of as much importance as the air stream properties which are often used alone as the basis of design calculations. In food drying, the final quality of the product is of such great importance and involves so many variables that the analysis of the drying operation is influenced greatly by the type of food being dried. In general, the food to be dried will establish the maximum temperatures of drying and the maximum allowable humidity conditions.

Essential Design Information

In the design and operation of tunnel dryers, it is essential to have information on the material balance, the heat balance, and the drying rate.

The material balance is important in determining the humidity conditions in the dryer, and these must be known if control of the final moisture content is to be maintained. Thus, it is important to maintain the air flow high enough to prevent saturation of the air at any point in the dryer.

The heat balance is important in determining the air requirements and the efficiency of the dryer. Thus, by means of the heat balance the heat lost from the dryer by radiation may be determined as well as the heat thrown out in the exhaust gases.

From the standpoint of design, the drying rate is most important because it establishes the size of the dryer. In general, rate data can be obtained only from experiment or from tests on large-scale units.

Expanding

The rapidly expanding demand for dried foods to meet Army, Navy, and lend-lease requirements is forcing more and more plant engineers and operators, consultants, contractors, and others to become familiar, in a relatively short time, with the field of drying and its ramifications. It was the purpose of a previous series of articles by Dr. Marshall, published in the September 1942-December 1942 issues of HPAC, to present a general picture of industrial drying practice and theory, and to show how they may be applied to food drying in order that those who are becoming acquainted with problems of drying for the first time may be able better to understand the underlying principles involved. An article in the January 1943 HPAC considered some of the problems involved in the selection, design, and operation of dryers which are adaptable to the drying of foods. In November, detailed calculations for compartment type dryers were given, the calculations illustrating the air conditioning problems involved. This month, tunnel type dryers are analyzed from the air conditioning engineer's point of view.

The author has specialized in the subject of drying, and is connected with the technical division of the engineering department at E. I. du Pont de Nemours & Co.

Countercurrent Flow Dryer

In countercurrent operation, the air and solid streams flow in opposite directions. It is known from thermodynamic considerations that counterflow processes more nearly approach reversible operation, which implies the most efficient operation from the standpoint of heat utilization. However, since thermodynamics disregards intermediate conditions and is concerned with end results only, the criterion of reversibility must be tempered by what actually occurs during drying. Thus, it often happens that other practical considerations make the use of parallel air flow, for instance, more suited to the operation than countercurrent flow. The chief advantage of counterflow operation in food drying lies in the fact that the driest food contacts the driest and warmest air, a condition necessary to meet the requirements of low final moisture content combined with rapid drying.

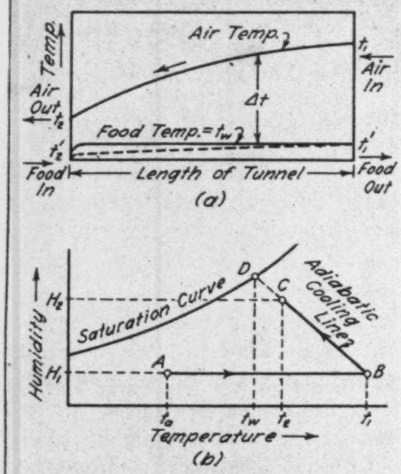


FIG. 1—COUNTERCURRENT AIR FLOW WITH SURFACE EVAPORATION ONLY

Let us consider three conditions of operation which may be encountered in a counterflow tunnel dryer:

The *first* condition which might be encountered corresponds to the constant-rate period of tray drying, or the period in which the material loses moisture by evaporation from its exposed surface. This condition of surface evaporation throughout the tunnel is shown in Fig. 1a. In this diagram the abscissa represents the length of the tunnel and the ordinate represents temperatures of the air and material streams.

The temperatures of the air and material along the tunnel have been represented on the basis that no heat is lost by the air except for the evaporation of moisture from the wet solid; that is, the dryer operates adiabatically. As noted in the diagram, the air temperature drops steadily as it passes through the tunnel, but the food remains at a constant temperature which depends upon and is often equal to the wet bulb temperature of the entering air. Thus, the food temperature in this case will depend upon the humidity of the inlet air — the higher the humidity the higher the food temperature. Whether or not the food actually reaches the wet bulb temperature depends upon the air velocity over the trays since radiation from hotter surfaces tends to raise the temperature of the food above the wet bulb temperature. High velocities (10-15 fps) reduce the effect of radiation. If the air loses heat to the surroundings so that its drop in temperature is not due to heat transferred for evaporation only, then the temperature of the wet food will vary according to the dotted line; i.e., the wet bulb temperature of the air will change along the tunnel.

The changes in the humidity conditions of the air before heating and during drying are shown on the skeleton psychrometric chart of Fig. 1b. At *A* the air is at atmospheric temperature and humidity prior to entering the heating elements of the dryer. Point *B* represents the temperature and humidity of the air as it enters the dryer, and its wet bulb temperature is represented by t_w. As drying proceeds, the temperature and humidity of the air follow the adiabatic saturation line *BCD* because heat is being utilized for evaporation only. Point *C* represents the condition of the air as it leaves the dryer. Point *D* represents the condition of adiabatic saturation; i.e., the condition of an infinitely long tunnel in which the air becomes saturated by virtue of a quantitative transformation of the heat it lost into latent heat of evaporation.

For the condition of surface evaporation only, the equations for heat and material balances and for the drying rate are as follows:

Material balance from the feed end to any point in the dryer,

$$F\,(w_2 - w) = GS(H_2 - H) \quad ..[1]$$

where the symbols are defined in the table of nomenclature.

Heat balance from the feed end to any point in the dryer:

$$GSs(t - t_2) = F\lambda(w_2 - w) \quad .[2]$$

Drying rate: This may be expressed in terms of the rate of mass transfer or the rate of heat transfer.

NOMENCLATURE

A = area of heat transfer or evaporation, sq ft;
c = heat capacity of the dry food, Btu per lb per F;
d = symbol for ordinary derivative;
f = functional notation;
F = weight of dry food entering the dryer, lb per hr;
G = air mass velocity, lb of dry air per hr per sq ft of cross section;
h = coefficient of heat transfer, Btu per hr per sq ft per F;
H = absolute humidity of the air, lb per lb;
k = mass transfer coefficient defined by equation 3;
k′ = 1.61 *k*;
K = drying coefficient for the falling rate period defined by equation 6;
q = Btu per hr;
S = cross sectional area of air flow, sq ft;
s = humid heat of air, Btu per lb of dry air per F;
t = temperature of the air stream, F;
t′ = temperature of the material stream, F;
w = moisture content (dry basis), lb of water per lb of dry food.

Subscripts

1 refers to the food discharge end of the tunnel;
2 refers to the food entrance end of the tunnel;
a refers to atmospheric conditions;
c refers to the critical moisture content;
e refers to evaporation temperature;
E refers to equilibrium moisture content;
m refers to average or integrated mean conditions;
n refers to the *n*th truck;
p refers to the total number of trucks;
w refers to the wet bulb temperature.

Greek Letters

Δ is symbol for difference in referring to temperature or humidity differences as forces causing drying to proceed;
λ is latent heat of vaporization, Btu per lb;
Σ is symbol for summation;
θ is time, hr.

Rate of mass transfer,

$$\frac{dw}{d\Theta} = k\ (\Delta p)_m$$
$$= k'\ (\Delta H)_m \ \ldots\ldots\ldots\ldots [3]$$

where k and k' are functions of the air mass velocity.

Rate of heat transfer

$$q = hA\ (\Delta t)_m \ \ldots\ldots\ldots\ldots [4]$$

where Δt is represented in Fig. 1a by the distance between the temperature curves for the air and material streams.

In equations 3 and 4 it can be shown that in most cases the mean values of $\triangle H$ and $\triangle t$ for this condition of countercurrent flow are the logarithmic means of the terminal values of these driving forces. In other cases, the true mean values can be determined only by integration along the length of the dryer.

The value of heat transfer coefficients must be determined experimentally, or estimated from available heat transfer data.

Since $q = F\lambda(w_2 - w_1)$ the drying rate is

$$F(w_2 - w_1) = \frac{hA\,(\Delta t)_m}{\lambda}$$

Thus, the required tray area for this case is given by

$$A = \frac{F\,\lambda\,(w_2 - w_1)}{h\,(\Delta t)_m}$$

Where h is known or can be determined, A may be calculated. Conversely, from known values of A and known operating conditions, h may be determined. For surface evaporation only, h is generally a function of air velocity.

The *second* condition to be considered is shown in Fig. 2; here, both the air and food temperatures change throughout the tunnel as indicated in Fig. 2a. This corresponds to the condition in which the surface of the food is no longer wet and evaporation takes place in the interior of the solid, so that the heat from the air is used to heat up the food as well as to evaporate the moisture. Since the surface of the food is no longer wet, the wet bulb cooling effect does not occur and the solid temperature rises. It is at this stage that the air temperature must be maintained low enough to prevent overheating of the food. The driving force for heat transfer is shown by $\triangle t$ between the two curves.

The change in temperature and humidity of the air along the dryer is shown in Fig. 2b. Because heat is used for purposes other than evaporation, the path of the air conditions no longer follows a line of adiabatic saturation. Point *A* represents the temperature and humidity of the air as it enters the heating elements of the dryer, and *B* represents its condition as it enters the dryer. Line *BC* shows the path taken by the air as it progresses through the tunnel, and it indicates a deviation from the adiabatic saturation curve shown by *BD*.

The material balance for this condition is the same as equation 1. The heat balance and rate equations for this condition are as follows:

Heat balance from the feed end of the dryer to any point along the tunnel:

$$GSs\ (t - t_2) = F\lambda(w_2 - w) + Fc(t' - t_2') + 0.45\ F(w_2 - w)\ (t - t_e') + F(w_2 - w)\ (t_e' - t_2') \ \ldots\ldots\ldots\ldots [5]$$

Although the value of t_e', the temperature of evaporation, changes with moisture content, nevertheless it is satisfactory for calculation purposes to use t_e' as the average wet bulb temperature of the air through the dryer. The items on the right-hand side of the foregoing heat balance represent latent heat to evaporate the water, sensible heat to the dry food, superheat to the water vapor, where 0.45 is the specific heat of water vapor, and sensible heat to the water in the food. Equation 5 assumes no heat losses. In general, heat losses will be encountered and must be considered in any design problem.

Rate of mass transfer

$$\frac{dw}{d\Theta} = Kf(w - w_E) \ \ldots\ldots\ldots [6]$$

where K is a constant which depends upon the food characteristics and $f\ (w - w_E)$ is some function of the free moisture content. In many cases it is possible to use a logarithmic mean free moisture content between the moisture content where surface evaporation ceases and some final or equilibrium moisture content. Thus, the rate expression might become

$$\frac{dw}{d\Theta} = K\ (w - w_E)_m \ \ldots\ldots\ldots [7]$$

where

$$(w - w_E)_m = \frac{(w_c - w_E) - (w_1 - w_E)}{\ln \dfrac{(w_c - w_E)}{(w_1 - w_E)}} = \frac{(w_c - w_1)}{\ln \dfrac{(w_c - w_E)}{(w_1 - w_E)}}$$

Rate of heat transfer:

$$q = UA\,(\Delta t)_m \ \ldots\ldots\ldots\ldots [8]$$

where U is now an overall heat transfer coefficient depending upon the thermal conductivity and thickness of the food. Δt is represented in Fig. 2a.

The *third* condition, shown in Fig. 3, is a combination of the first two and represents the general case for the tunnel dryer with countercurrent air flow. Thus, there will be a period of constant surface temperature followed by a period of rising temperature, Fig. 3a.

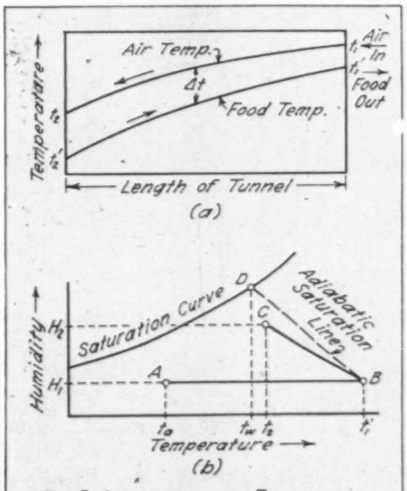


FIG. 2–COUNTERCURRENT FLOW WITH SUBSURFACE EVAPORATION THROUGHOUT

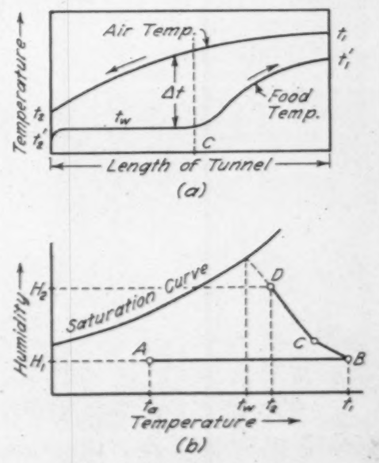


FIG. 3–GENERAL CONDITIONS FOR COUNTERCURRENT FLOW

The air conditions shown in Fig. 3b indicate a combination of Figs. 1b and 2b. The air enters the heaters with the conditions represented by *A*. It leaves the heaters at the temperature and humidity of point *B*. It then follows a path *BC* by virtue of the fact that much of its heat initially goes into heating the food and less into evaporation. At point *C*, corresponding to *C* in 3a, the air follows the adiabatic saturation line *CD* for the remainder of its passage through the dryer.

The material balance for this condition is the same as equation 1, while the heat balance is the same as the general equation 5. The rate equations must be used according to the zone under consideration so that from the standpoint of the drying rate the tunnel must be divided into the zones covered by the first and second conditions; i.e., by equations 3 and 4, and equations 6 and 8, respectively.

Parallel Flow Dryer

In parallel flow operation, the air and material enter the tunnel at the same end and both leave at the opposite end. With such an arrangement the wettest portion of the charge comes into contact with the hottest and driest air, while the material leaving the dryer leaves in contact with cooler, more humid air — a very undesirable condition in food drying.

The same three conditions described above for counterflow will be considered for parallel flow to determine how the use of parallel air flow affects the heat and material balances and rate relationships.

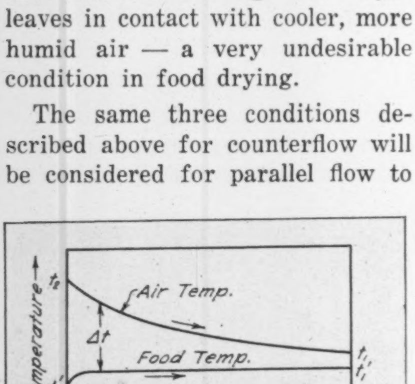


FIG. 4—PARALLEL FLOW WITH SURFACE EVAPORATION ONLY

In the *first* condition for parallel flow, the surface of the material remains wet throughout the tunnel, and the temperature of the food remains at the wet bulb temperature of the entering air if adiabatic conditions prevail. This is shown diagrammatically in Fig. 4a. The large temperature difference between the air and food at the feed end of the dryer should be noted. Under the same conditions of air flow and temperatures, parallel flow will require a longer tunnel than counterflow to produce the same amount of dry product. The changes in air conditions, represented in Fig. 4b, are similar to those shown in Fig. 1b. Thus, the air follows an adiabatic saturation line corresponding to the wet bulb temperature of the air entering the dryer, point *B*. Even with moderate heat losses the air will follow path *BC* quite closely, because (in general) the heat for evaporation is large compared with the heat losses.

The material balance for this condition is given by

$$F(w_2 - w) = GS(H - H_2) \quad .[9]$$

The heat balance for this condition is as follows:

$$GSs(t_2 - t) = F\lambda(w_2 - w) \quad [10]$$

The rates of mass and heat transfer, likewise, are expressed by equations 3 and 4, with the same remarks holding for parallel flow.

In the *second* condition of parallel flow, the material loses moisture by subsurface evaporation, and hence its temperature rises continuously throughout the dryer. Unlike the countercurrent flow case, however, the material temperature can go through a maximum as shown in Fig. 5a. The air temperature falls continuously and approaches the material temperature. This tends to produce a smaller and smaller $\triangle t$, which may reduce the drying rate to a negligible value at the discharge end of the dryer.

The changes in air conditions are shown in Fig. 5b, which is analogous to Fig. 2b. The heat lost by the air appears as sensible heat in the food as well as latent heat. The path of the air, *BC*, crosses several adiabatic cooling lines, instead of following one.

The material and heat balances for this condition, as well as the rate equations, correspond to equations 1, 5, 6, and 8, with proper account being given to signs due to change in air direction. It is to be noted that in the case of the rate equations, the low $\triangle t$ or $(w - w_E)$ tends to reduce the overall drying rate considerably below that for countercurrent air flow.

The *third* condition represents the combination of the first and second conditions for parallel flow, i.e., the general case to be expected for parallel air flow. The air stream enters at a high temperature at the feed end and an initially large $\triangle t$ occurs, Fig. 6a. The material shows a slight warming-up period, *AB*, and then exhibits the constant temperature zone *BC* followed by the zone of increasing temperature and a possible point of maximum temperature. The temperature difference between air and food is shown by $\triangle t$, and it is seen to be quite variable through the dryer, thereby requiring some integration method to determine the true overall mean $\triangle t$.

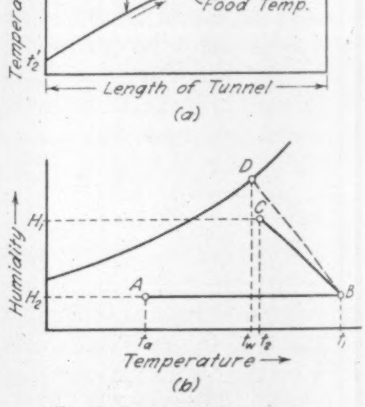


FIG. 5—PARALLEL FLOW WITH SUBSURFACE EVAPORATION ONLY

The changes in air conditions, Fig. 6b, are the reverse of those for the third condition of countercurrent flow, since in the parallel flow case the air first follows a line of adiabatic saturation, *BC*, and then slopes off, *CD*, as the heat given up no longer produces a quantitive increase in humidity but goes in part into sensible heat. See Fig. 6b.

The equations for heat and material balances and for the rates of mass and heat transfer are identical with those for the third or general condition for countercurrent flow, proper account being taken for changes in sign.

Center Exhaust Tunnel Dryer

In this arrangement of the tunnel dryer, an effort is made to combine the best features of countercurrent and parallel flow. This is done by causing the air to flow parallel to the food during the period of surface evaporation because the wet bulb cooling effect allows the use of hotter air initially without endangering the quality of the food. Countercurrent air flow is used in the latter portion of the tunnel where hot dry air is required to produce the desired final moisture content. The courses of the air and food temperatures are shown diagrammatically in Fig. 7a. The point of center exhaust has been selected at the point where surface evaporation ceases. It is to be noted that the temperature difference, $\triangle t$, never falls off to a negligible value when this arrangement is used.

Because the air from the countercurrent flow section leaves at a lower humidity and with valuable heat content at a reasonably high temperature level, it is advantageous to mix this air with the air entering the dryer at the feed end. This condition is illustrated in Fig. 7b. Point A represents atmospheric air conditions, B represents the conditions of the air entering the counterflow section, while C represents the air conditions leaving this section. Point D represents the condition of mixing the exhaust from the counterflow section with fresh air prior to entering the heaters to the parallel flow section. Point E shows the air conditions at the entrance to the parallel flow section. In this section the air changes according to path EF, which represents an adiabatic cooling line.

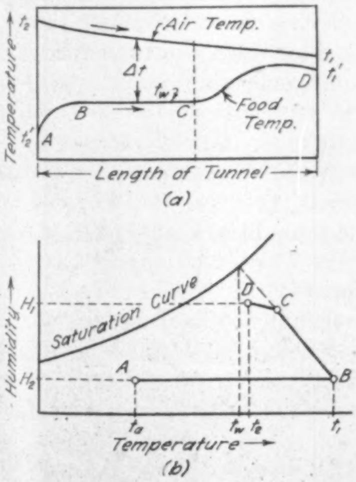


FIG. 6—PARALLEL FLOW WITH SURFACE AND SUBSURFACE EVAPORATION

The heat, material, and rate relationships for this case are the same as those for the first condition of the parallel flow case, and the second condition of the counterflow case.

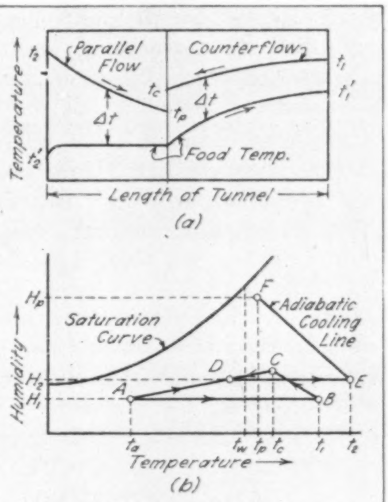


FIG. 7—TEMPERATURE AND HUMIDITY CONDITIONS IN CENTER EXHAUST TUNNEL

Non-Adiabatic Operation

It sometimes happens in tunnel drying that a constant temperature is desired throughout the tunnel. This requires heating coils spaced at intervals along the dryer, and the air is caused to spiral through these coils before passing through each truck of food trays. In some cases there may be a heating coil at each truck position.

In constant temperature tunnels, the air and material temperature relationships for all conditions of air flow and moisture evaporation are shown in Fig. 8a. The material temperature rises steadily along the dryer, because the air wet bulb temperature continually changes with reheating. The difference between parallel and countercurrent flow for this case is that more humid air contacts the dry product in the former, and this is not especially desirable. In general, constant temperature tunnel dryers are shorter than other types for a given production capacity. The drop in air temperature over each truck is shown by the dotted sawtooth curves.

The change in conditions is shown in 8b. Depending on the direction of flow, the incremental paths BA_1, B_1A_2, etc., will be short or long at the start according to whether the air is in countercurrent or parallel flow. The length of the paths A_n B_n is a direct measure of the heater sizes for each reheat section. At the wet end of the dryer, the inclined paths will follow adiabatic saturation lines.

The material balance for this case is given by equation 1.

Heat Requirements

The heat transferred may be expressed by means of the right member of equation 5, since the left member does not apply in this case. Experimentally a heat balance would require the collection of condensate from the steam coils. The heat requirements for the dryer might also be expressed as follows:

$$q = GS\ \Sigma_1^p\ s_n\ (t - t_n) \ldots . [11]$$

where $(t - t_n)$ represents the temperature drop in the air on passing over a single truck, and p is the number of trucks or the number of reheat sections corresponding to A_nB_n of Fig. 8b.

The rates of mass and heat transfer may be determined from equations 3 and 4 respectively.

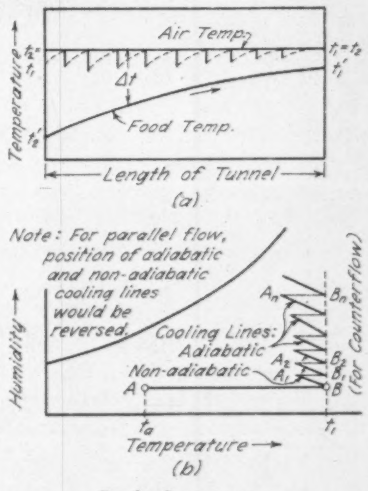


FIG. 8—CONDITIONS IN CONSTANT TEMPERATURE TUNNEL

* * *

It is good business, as well as your patriotic duty, to save fuel—coal, oil, gas, or wood—by heating efficiently. Uncle Sam wants you to fight waste!

"OPEN for DISCUSSION"

Adopt Metric System as Part of Coordination of Building Dimensions

THE EDITOR—

I have been following with some interest the articles and the attendant discussion (pp. 585-586 of the November HPAC, for example) in reference to the adoption of the modular system of coordinated dimensions proposed to be adopted as a standard measuring unit for construction materials and architectural design. In connection with the discussion of such a revolutionary step in the practice of the co-related technical and industry branches which will be involved and the far reaching effects of the adoption of any new unit of measurement, might I be privileged to offer a suggestion for the consideration of the committees proposing this new standard?

The establishment of a standard of measurement and its ultimate adoption by those whose technical and business activities may find that particular unit of benefit to themselves should, I believe, extend the horizon sufficiently into the anticipated future to establish the effect on both the generally accepted domestic unit of measurement and the increasing tendency to adopt an international standard which may be universally acceptable. The visualization and application of a revised measuring unit will require an appreciable period of education and familiarity with use in order to make it a tool of improved performance and, if this be so, would it not be preferable to adopt a unit universally understandable and perhaps more easily applied? Could not the adoption of the international meter and its recognized subdivisions be made to serve the purposes of the module as well as to provide dimensioning of both structural and technical materials, which will rapidly improve our position in postwar commerce as well as to more closely coordinate our research and control laboratories with the industries they serve at home?

The establishment of standards of measurement, like manufacturing and manufacturers' products, does require a major operation in reorganization of plant facilities. It might be better to extend the effects of such an operation to encompass the correction of more ills than the one under immediate consideration, and at the same time provide adjustments which sooner or later must be recognized if we are to retain our present enviable position with respect to industrial accomplishment.

It would seem that the matter of related proportions of building and construction materials could be as well handled by dimensioning in units of one accepted system as in another, and obviously simplification is the ultimate endpoint desired. The relationships of length, width, and thickness could as well be expressed in units and decimals of the metric system as in feet, inches, and fractions, or in modules and multiples and fractions thereof. It is admitted that the questionable prestige of originality would be absent in adopting metric measurements, yet I believe such adoption might prove to be even more desirable once agreement had been reached to make its application universal throughout American industry.

It has long been recognized that we have been working with an obsolete system of measurement that is cumbersome, that is subject to dimensional illegibility on drawings, and is in effect obsolete in providing easily identifiable interpretation in the complex formulary of physical and engineering research and application. We are now passing through a refining process of research and production accomplishment which will prove close to revolutionary when all the facts may become known. Why not let us set our house more completely in order and divest ourselves of many obsolete forms at the time when this may be most easily accomplished?—LESTER H. GARDNER, consulting engineer.

Postwar Construction Needs, Planning Should Be Surveyed

THE EDITOR—

From my observations I do not get the same view of immediate postwar building conditions as Samuel R. Lewis outlines, on p. 581 of the November HPAC, for while he is very fortunate in the amount of postwar work confronting him—and I seem to be fortunate in this respect also—I know that there are very few architects and engineers in New York who are similarly situated, except those who are beneficiaries of state or city planning, which is based upon city, state, or federal tax funds, i.e., the people's pockets.

I can find very little interest among private business in New York in initiating architectural and engineering work upon postwar structures. There are those who definitely intend to erect theaters, apartment, office or industrial buildings, and other structures, those who expect to modernize buildings, install air conditioning, etc., but they appear content to await the end of the war to see what then happens before taking any steps toward plan making. If this situation continues there exists the probability of a long postwar period of hesitation, analysis, decision making, then months of plan making, letting of contracts, and a slow getting of new construction and labor employment under way.

It is to stir up these private interests, which do not involve public

Welcome

HPAC's readers and editors will welcome your comment on articles or parts of articles published in these pages, and on other topics of interest to those concerned with design, installation, operation, and maintenance of heating, piping, and air conditioning systems in industrial plants, commercial, institutional, and public buildings. Address The Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

This month, Lester H. Gardner suggests adoption of the metric system along with the program for coordinating dimensions of building materials and equipment as described in November. Dwight D. Kimball proposes a study based upon a survey of postwar building needs and postwar planning in sight, justifying the making of plans now for postwar construction. Ralph M. Shaw Jr. discusses methods of bending pipe.

tax money, that I think something might be done to show the advantages to the owner and to the country generally in the absorption of postwar unemployed labor which otherwise would constitute a heavy burden upon the country, resulting in more boondoogling and leaf raking.

I may be altogether wrong in my view of the situation, but this is the result of my study and prospecting.

It seems to me that to be effective there should be published a study based upon a survey of:

1) Building needs (of various types).
2) Postwar planning in sight, public and private.
3) Justification of making plans now for postwar construction.
  a) Time saved in getting new construction under way.
  b) Absorption of the postwar unemployed.
  c) Patriotic motives.

Such a study should be soundly based, analytical, and persuasively written. It would be a real job. Perhaps, if done at all, it might be the work of some committee, possibly of the ASHVE. Maybe it is not worth doing. Frankly, I do not know.—Dwight D. Kimball, consulting engineer, member of HPAC's board of consulting & contributing editors.

Cold Bending of Pipe for Fighting Ships

The Editor—

I enjoyed very much reading the November issue, particularly the article that Joe Klein wrote on cold bending pipe on p. 590.

Essentially, everything that Mr. Klein says is right; however, the art has considerably advanced since Mr. Klein purchased his bending machine.

Bending machines are made in many different forms. There are essentially six processes for bending pipe, of which the hot process is one. There is one more process for effecting a bend, known as the process of cutting, threading and screwing same into the purchased fitting. I think I can show for a given size, let us say 4 in., why it is more economical to use a cold bending process than either the hot bending or fitting process, so long as there are a sufficient number of bends to make it worthwhile. The number of bends required to make this saving effective is about four to five hundred per year, which would take about 30 to 35 hr per year for a good bending machine.

The cost of making a 4 in. bend, based upon a production of 2000 hr a year and a 50 per cent work factor, is 26.6c per bend, which includes labor, overhead, power, amortization, and interest, but does not include the material. The comparable cost for hot bending, assuming a shop of sufficient organization to enable the plant to load the pipe with sand, heat it, and empty the pipe of sand at the same time that the bending is being done, would amount to $2.44 per bend, including the above items of cost. If a fitting process is used, the cost is approximately $1.50 per bend, assuming the use of a mechanical cutter and threader and the fact that the fittings are purchased in bulk, the bulk consisting of either 1000 fittings or a carload lot.

Coming to the question of cold bending there are the following processes, of which Mr. Klein mentions two: There is the press process, which is used for most hydraulic benders and operates on the same principle as the rail bender, used for bending railroad track. There is the draw process, which is the other process described by Mr. Klein, wherein the piece is drawn cold over a die and over a mandrel. There is also the roll process, wherein the piece is rolled by a pyramid, comprising three rollers, similar to the action of a portable rolling mill, and there is the compression process, wherein the piece is wiped into the die by a moving arm.

A last process embodies all of the miscellaneous processes used for bending special shapes. Example of the last process is the one developed by RCA Victor for bending the tube on the arm of a phonograph and which is done, I am told, by driving a series of balls of varying sizes through the finished bend to open it up to the desired size by means of a pneumatic hammer. The miscellaneous process also includes the process of manufacturing welding fittings which, I believe, is a patented one and consists of drawing a heated tube over a horseshoe mandrel of the desired shape. The tension process referred to by Mr. Klein is used primarily for thin wall tubing and it is the only process which is applicable for thin walled tubing, wherein the bend is achieved without additional work before and after bending. The tension process will produce a bend of great accuracy to a very close radius indeed, provided the material is thoroughly ductile; considerable skill is required to operate it, as Mr. Klein mentions in his article, since the position of a mandrel is critical. The machine used is large, heavy, and expensive.

The compression process lends itself to the production of pipe bending more satisfactorily, we believe, than any other process available. In the first place, the machine is inexpensive compared to the other processes, which means the amortization and the interest is low, the production speed is high, which means that the cost per bend is low, the skill required to operate it is nominal, which means that the labor cost is low. The percentage of rejected work is small and the maintenance is nominal. The costs referred to above are based upon the bending of pipe by the compression process. In the compression process no mandrel is used and no clamps are needed. The pipe is merely laid against the die with a suitable stop-arm placed against it and the bending arm wipes the pipe into the die in very much the same method as wire is wrapped around a pole. The amount of power required to do this is about the same as that of a tension machine, but the number of men required to perform the operation is approximately half that of a tension machine. Six inch pipe can be readily handled with two men; 8 in. pipe requires about three men; 4 in. pipe and smaller needs only one man. Production speeds are very high, higher than with other types of large pipe bending machines. A 6 in. pipe may be bent from floor to floor in anywhere from 6 to 10 min and if a great many bends are required of identical shape so that a jig may be used, this time is reduced to about 4 min. The longest job in connection with making a compression bend is deciding where you want to make the bend and how much curvature you require. In other words, if the bend is made to a template, it is a long process, but if a large number of bends are required to the same template a relay, supplied with the machine, may be set after the first bend is made which will make all the other bends identical, thus saving an immense amount of time.

Mr. Klein stated that the amount of tangent required on an offset is 1 in. If the compression process is used the minimum tangent is zero, regardless of the direction of the offset. In other words, one bend may be made to run into the next bend even though the direction is displaced 90 deg. This is the most difficult bend to make on a tension machine. Furthermore, a tension machine requires a straight pipe and an additional bend cannot be put into a pipe between existing bends without a great deal of difficulty. In many shipbuilding operations where a pipe must be run along a finished ship and the bends made more or less "by guess and by gosh", a template is often incorrectly laid out and when you get the finished pipe all ready to weld in you discover that one bend, in usually the most inaccessible spot, is about 5 deg open. If you have a tension machine you are out of luck; you have to take a new piece of pipe and put in all the rest of the bends, including the defective one, or you have to cut the bend out of the finished length with a torch, take it down to the bending table, and complete the bend and then weld it back into section. This all takes time and costs money. If your machine, however, is a compression machine, you merely take the length to the machine and add about 5 deg more curvature to it without any fuss or worry, because the compression machine requires no mandrel to become fouled in intervening bends.

The flattening effect of a compression bend is approximately 5 per cent for bends having no closer than a radius measured to the center line of three times the nominal pipe diameter for sizes of 4 in. to 8 in. In other words, if the pipe is 5 in. in diameter, a 5 per cent flattening effect will be ¼ in. and this is acceptable under the specifications of most of the armed services. With a tension machine operating without a mandrel, the flattening effect is very much greater. With a tension machine operating with a mandrel the flattening effect will depend upon the accuracy of the location of the mandrel and may vary from as low as 3 to as high as 15 per cent, depending also upon the radius of the bend.

I have gone into this subject rather completely, because I believe that the very excellent article by Mr. Klein should be supplemented so as to bring this very interesting engineering development right up to the minute.—Ralph M. Shaw Jr., president, Pedrick Tool & Machine Co.

REFRIGERATION GOES FROM STORE TO WAR

A large refrigerating machine that helped Marshall Field & Co.'s customers to shop in cool comfort has gone to war. One of the two centrifugal machines of 500 ton capacity is now helping to speed production of synthetic rubber treads for tanks at a General Motors plant.

At the Chicago store the machine chilled water to cool the air for the basement of the main building, the store for men, and other smaller departments throughout the main store. In its new war work it cools the processing rolls in the manufacture of synthetic rubber.

Penicillin Process Requires Rigorous Temperature Control

Penicillin (accent on the second syllable) is another of the vital wartime and peacetime products which depend upon rigorous temperature control for the success of the manufacturing process. Twenty-four degrees Centigrade (75.2 F) has been found to be the optimum temperature at one laboratory recently visited; above 26 C, the "harvest" of penicillin falls off very rapidly. At lower temperatures, the drop off is not as great, but at 15 C the harvest is considerably less than at 24 C.

Penicillin, you undoubtedly know, is obtained from molds (like bread mold). The molds at this laboratory are grown in glass bottles lying on shelves in a room held at 24 C by a suspended type unit cooler, supplied by a remotely-installed condensing unit. Electric strip heaters are provided for close control when heating is required, and cooler and heaters are governed by a room thermostat. The room has double tile walls with an air space between, and an insulated door, to reduce heat gains or losses to the minimum. No humidity control is required, as the molds are inside the bottles and "provide their own humidity conditions."

EXTRA!

School Engineers DECLARE WAR on Fuel Waste

Engineers and firemen meet on Armistice Day to discuss ways and means of heating efficiently. Success of fuel conservation program depends on "man on firing line"

WAR was declared on Armistice Day last month—a war on fuel waste—when more than 950 engineer-custodians, their supervisors, and their assistants met at Marshall high school, Chicago, to discuss ways and means of saving coal and electricity and effecting other economies in school building operation and maintenance. The ultimate success of a fuel conservation program depends upon the man on the fuel firing line, as John Howatt, chief engineer of the Chicago board of education, put it; the purpose of the all-day meeting was to explain the importance of conservation as a contribution to the war effort, and how fuel and energy can be saved, to the men in whose hands the success of the program rests. The ASHVE's war service committee, of which Mr. Howatt is chairman, has passed a resolution asking him to promote such meetings in other cities, and a number of school systems are planning fuel conservation programs.

Heat Seal All Buildings

In his introductory remarks, Chief Howatt said that bituminous coal is the nation's No. 1 heating fuel and that—surprisingly—wood comes next. As to fuel oil, production (rather than transportation) is the bottleneck this year, for oil production is now "at the maximum efficient level," he said. The fuel oil shortage will be more critical this year than last, he expects. The greatly expanded fuel requirements of industry and the railroads, due to the war, make all-out conservation of all fuels of vital importance.

War turns many things topsy-turvy, Mr. Howatt remarked. The city smoke inspector, for example, serves the Office of Civilian Defense as a camouflage expert, part of his duties being to create smoke screens rather than to eliminate them. Electric utilities must now try to reduce many of the less essential uses of electricity, rather than to promote sales. A 10 per cent reduction in electricity used by the Chicago schools would save some 2000 tons of coal a year, according to Mr. Howatt.

Important coal savings for heating school buildings are possible. All buildings should be "heat sealed"; for example, there is 7000 lineal feet of crack around windows and doors in an average 24 room school, and it takes 3 tons of coal a week to heat the air that can come into the building through these cracks, he said. Excessive inside temperature is another source of fuel waste; 3 per cent of the fuel is wasted for every degree the inside temperature is above 70 F, he stated. Another way to conserve fuel is to close off all rooms which are not in use.

Fuel Conservation Reminders

(From Scotty-Grams)

Keeping a boiler room in a neat and orderly condition at all times, and the firing tools and equipment in good working condition, is usually a sign of efficient operation throughout the building.

Excessive puddling of fires by too frequent use of the slice bar means excessive clinkers with low-fusing-ash coals, and a consequent drop in efficiency.

Admission of too much excess air caused by a spotty fuel bed helps to chill the setting and takes heat away from the gases of combustion.

Soot accumulation reduces effective heating surface, and deteriorates tubes. Daily use of a steam lance or automatic flue blower is advisable where such equipment is available.

Better heat reflection may be secured by periodic removal of accumulated soot and fly ash from the bridge wall.

Short circuiting of furnace gases due to faulty baffles, and soot accumulation on the lower baffle of water tube boilers, will seriously affect boiler efficiency and capacity.

Frequent inspection should be made for water leakage past blowdown valves of water column, gage glass, and boiler drums.

Tanks and heaters should be blown down at regular intervals.

Firemen can more intelligently maintain steam pressure and keep fires under proper control if they are notified in advance of contemplated changes in steam demands.

(The engineer-custodian of the Marshall school gave a subtle demonstration of fuel conservation, for the auditorium in which the meeting was held was far from overheated. Many members of the audience regretted having checked their overcoats.)

The subject of fuel conservation was put aside at 11 a.m., when the board of education post of the American Legion presented a brief but impressive memorial ceremony. The board's bureau of engineering has 215 stars in its service flag, it was announced.

Following the Legion service, discussion of fuel problems was resumed with a talk on the coal situation by Frank Reed, vice-president of the Crerar Clinch Coal Co. O. T. Lay, meteorologist in charge of the Chicago Weather Bureau, then explained the method of computing degree days and their use, offering the complete cooperation of the Weather Bureau to operating engineers. Mr. Lay said that as of November 11, degree days for the current Chicago heating season were running 18 per cent over normal. Whether degree days are running above or below normal in any current heating season, the best estimate for the balance of the season is always that it will be normal, he stated.

Following a recess for lunch, which was served in the school's cafeteria, the afternoon session opened with a sound movie film entitled The Battle for Oil. It showed the vital importance of oil in the war effort of both the United Nations and the axis powers and the efforts made by both sides to keep their own fuel oil supply lines flowing and to check the flow to the enemy.

The firemen and engineers then took over and expressed their opinions on how fuel could be saved. Several important truths were brought out; one was that since no two buildings or plants are exactly alike, the formula for conservation of fuel must be rather general, leaving some latitude for variance to meet local or individual plant conditions. It is in adapting the general rules of fuel conservation to the individual plant that the capabilities of the engineer or fireman can be demonstrated. It is through such an application that the operating efficiency can be made better than average.

Building Occupants Must Cooperate

Another essential truth that was stressed referred to the need of cooperation among all—not only the plant operating staff but the occupants of the building. Trying to time the load demands to fit the efficient capacity of the plant requires cooperation by all in the building, and advance notice of any increase or decrease in the demand for steam helps the boiler room force to adjust their feeding of fuel so there will be little waste.

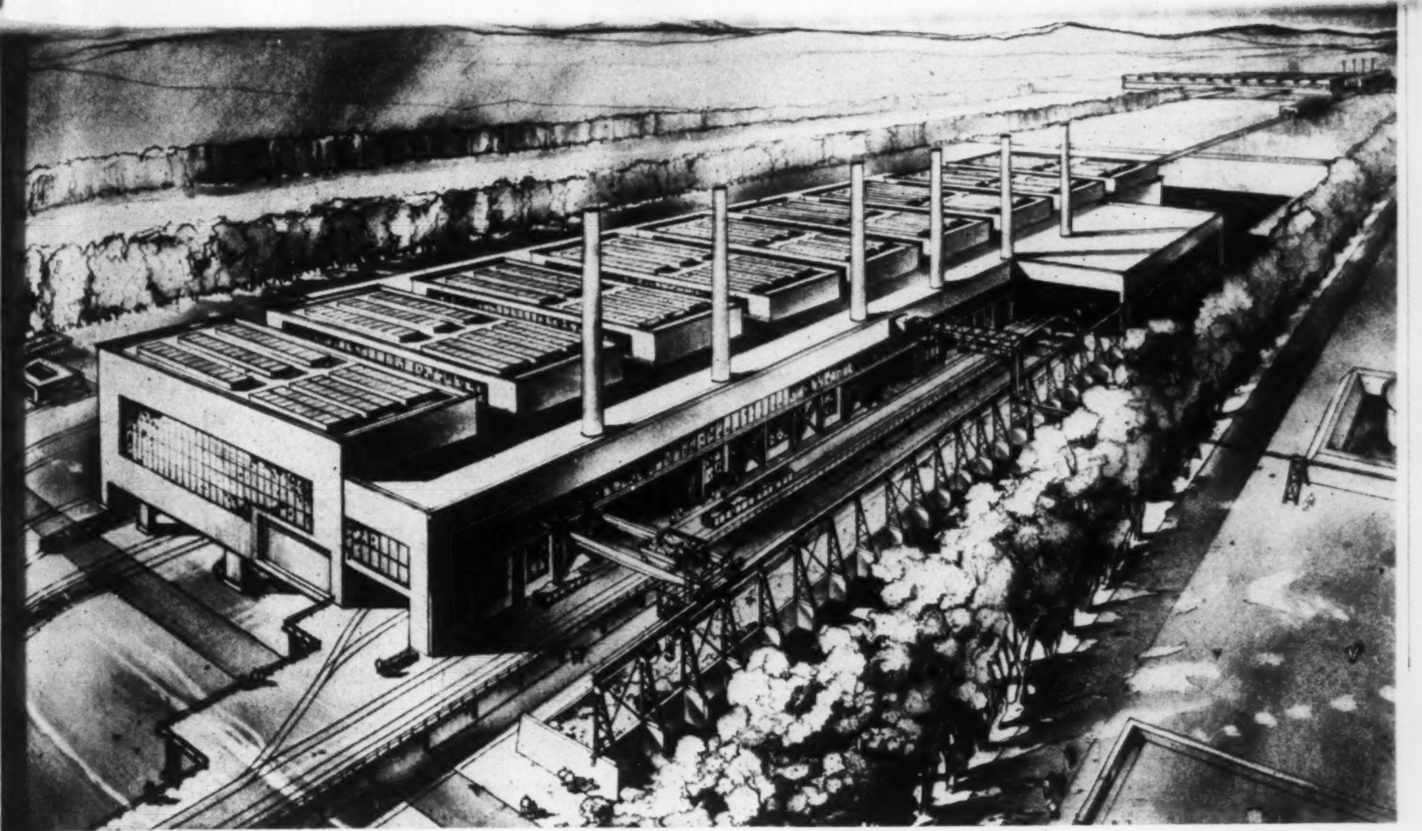
Another point stressed was the need of using judgment in changing the time at which heat is applied to the building in the morning to conform with the weather conditions that existed during the night. Starting up the plant either too early or too late is conducive to waste. The same truth applies to closing the plant at the end of the day. The wise operator does not arrive at the end of the day with a heavy fire in the furnace or even with a higher pressure of steam than is needed.

Heating Ventilation Air

The fallacy of the open window to flush out classrooms was ridiculed as a "moss covered heritage from the past." It was suggested that windows be locked with a key and all keys removed during the heating season. Excessive ventilation, too, came in for its discussion and the theory was advanced that recirculation of air should be carried out in heating and ventilating systems in school buildings much more than it is today. It was estimated that in a climate like that of Chicago, in supplying all outdoor air to meet the city ordinances for quantity, 40 per cent of the annual fuel requirement goes for ventilation and 60 per cent for heating the building.

Fuel conservation is not just a new, wartime program of the Chicago school system, as a display of material in the lobby demonstrated. Charts and tables of coal and electricity requirements over a period of years were shown; prominent in the display was a blow-up of an article on Promoting Operating Economy in School Plants, written by Mr. Howatt and published in the January 1932 issue of Heating, Piping & Air Conditioning.

The bureau of engineering of the Chicago board of education is publishing a monthly mimeographed bulletin, called Scotty-Grams, for its operating personnel. Conservation reminders from the first issue are shown on this page.



There are nine monitors for ventilation and lighting

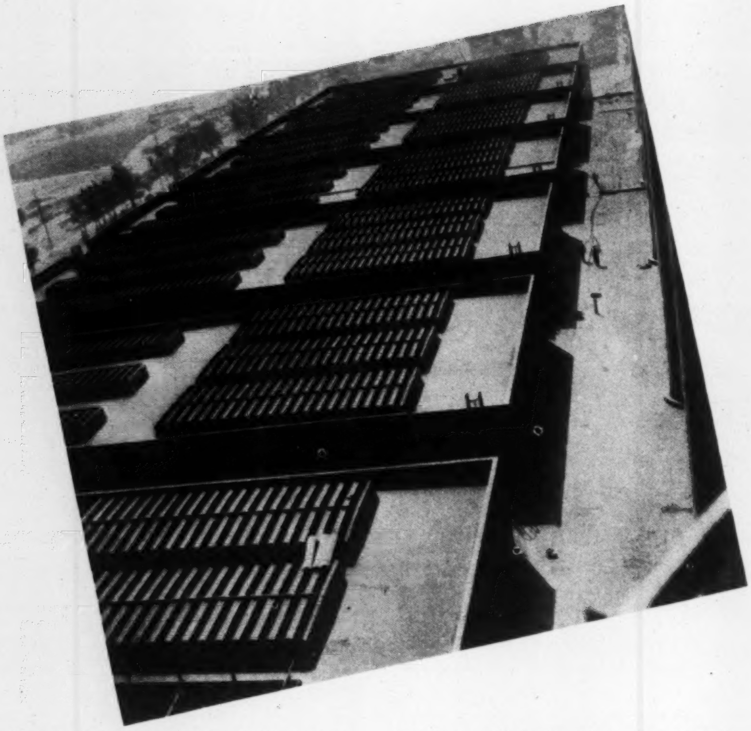
Big Gravity Ventilation System Serves Kaiser's New Steel Mill

George E. Skaggs, mechanical engineer with Donald R. Warren Co., engineers, describes why's and wherefor's of the gravity ventilation installation for the west's largest mill. Flexibility a prime consideration

BORN NOT only of war necessity but unquestionably destined to play a vital part in the west's postwar industrial development, the new Kaiser steel mill in California is not just a "local" mill, but is a completely integrated plant comprising all phases of the industry from furnaces to finished steel. Although the project is not yet complete, large scale operations have been going on since the first of this year when the first blast furnace was blown in.

Donald R. Warren Co. was retained by the iron and steel division of Kaiser Co. as the structural engineers. At the outset it was determined not to let past history in steel mill design have too great an influence on the plans for the project. It was decided that building utility, operating efficiency, and streamline production could be combined with architectural harmony of building design to produce a project as pleasing to the eye and as symmetrical in design as any modern institution. Thus, the visitor sees not a "steel mill" in the usual unimpressive detail, but an extensive group of imposing buildings such as one might expect to find in a metropolitan area civic center. This is not "architectural revolution" but rather the application of modern architectural trends to a class of buildings heretofore almost wholly neglected from that standpoint. Many innovations were bound to result, not the least of which is the effective method of large scale ventilation employed in the great majority of buildings.

It has been said this is the largest "gravity" ventilator installation ever made. More than 70 carloads of this equipment have been used on the buildings already completed, which are only a portion of the whole project. These ventilators are built in units 90 in. x 120



An average air volume of 10,000,00 cfm is removed from the open hearth building

in. and are 32 in. high. They are made of galvanized steel and installed in series adjoining and attached to each other, making a complete weathertight covering for that portion of the roof where installed. They were used on the open hearth building, stripper building, soaking pit building, ingot mold foundry, power plant, plate, structural, merchant, and alloy mills.

Many interesting problems had to be solved in laying out the ventilation for these buildings, although the system itself is unique in its simplicity. Desert conditions with temperatures exceeding 100 F and sand storms are periodical occurrences. These conditions were superimposed on th usual heat removal requirements of steel mill operations.

The method for designing th ventilation is typical for all buildings, and it will, therefore, serve our purpose here to describe that used for the open hearth building, which consists of 36 bays. Three bays out of every four are "raised" or monitor sections for most of the building width, leaving low flat roof sections on the north and south sides. The low sections extend through the entire building width every fourth bay. Thus are formed nine monitors 12 ft high for the purposes of lighting and ventilation. Only fixed sash is used in the monitors and the gravity ventilation equipment is installed on the top.

Flexibility of Ventilation

In selecting the method of ventilation the flexibility of the gravity system was one of the main considerations. This was especially true of the open hearth building where variations of temperature occur most frequently. Gravity

---

Air Conditioned Operating Rooms Have Five Advantages

When the Hahnemann hospital, Scranton, Pa., decided to remodel the part of the hospital containing the operating rooms, Superintendent L. R. Robbins, fellow of the American College of Hospital Administration, polled the surgeons on the staff regarding the desirability of air conditioning the operating rooms.

Opinion was unanimous that air conditioning would provide five advantages:

1) Temperature control winter and summer.
2) Humidity control to prevent patient dehydration in winter.
3) Humidity control to prevent static spark danger.
4) Elimination of dust and dilution of odors.
5) Comfort for surgeons and nurses.

It was decided to install air conditioning equipment for two operating rooms, one anesthetizing room, and a lobby into which these three rooms open. To meet the requirements, it was decided that each room should be provided with individual and separate control of temperature and humidity, that the system should provide ample ventilation, should operate quietly without objectionable noise, and that the air distribution should be of the type to assure complete freedom from drafts.

The engineers of the Power Engineering Corp., Carrier distributors, submitted a design to meet these requirements. As a result, a central type air conditioning unit was installed with individual zone control for each room and with distribution through ceiling diffusers. The system is fully automatic at all seasons and operates with 100 per cent outside supply air with exhaust through a sterilizing room which is between the two operating rooms.

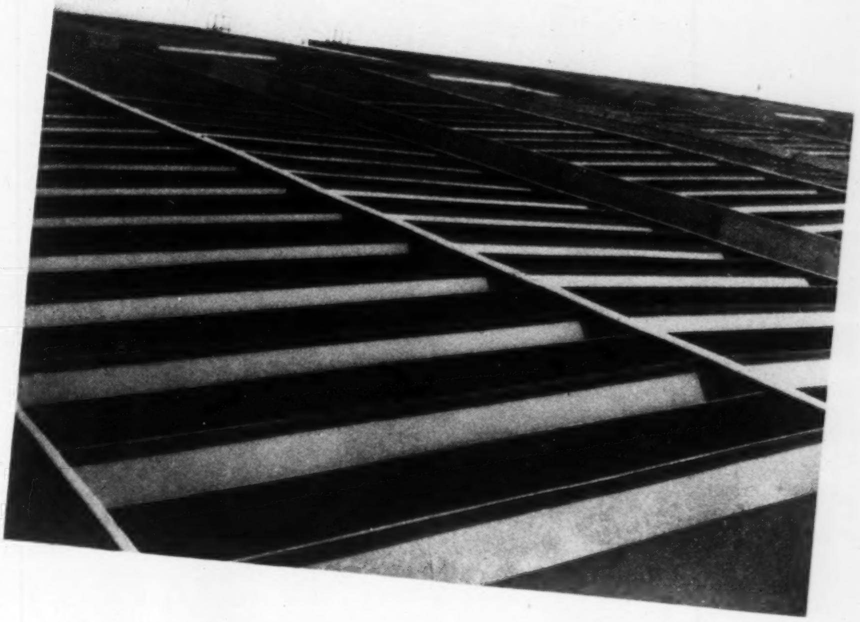
A number of interesting problems arose in the course of the installation. For example, since the rooms served include spaces where explosive gases are handled, the controls for the unit could not be in the room where an electric spark might set off the gases. As the air conditioning unit is in an attic that is none too accessible, it was not practical to place the controls in the supply and return line in the attic. To meet these restrictions, a remote bulb type control was used. The thermostat was put in the attic, with the control panels in the air conditioned room. This makes it possible to regulate the controls

atio of intake opening to exhaust opening is better than 3 to 1

nits exhaust air volume in direct atio to the differential temperature between the inside and outside f the building. In other words, t can be said that building heat the motive power of the gravity nit.

The number of ventilators used, r the "ventilator roof coverage," s sometimes referred to with this ype of ventilator, is based on the elocity of air movement on the perating floor rather than the "heat absorption" and fixed volume xhaust. The velocity of ventilator xhaust during operations will ange from 350 to 750 linear feet er minute depending upon differntial temperatures; the highest elocities usually momentary with eat surges. But this flexibility aintains an almost constant vecity near the floor level.

The ventilator "roof coverage" s greatest directly over the furnaces, for obvious reasons. Here he ratio is 1 to 1.7 or approximately 60 per cent of the roof area. ver the pouring floor the ratio 1 to 3.5 or about 28 per cent overage. The ratio of openings total roof coverage is 40 per ent. Outside air intakes are provided by opening almost the entire lower portion of the building to a height of 8 ft. The greatest distance which air must be pulled is 170 ft. The ratio of intake opening to exhaust opening is better than 3 to 1. An average working level velocity of approximately 250 linear feet per minute is maintained.



In order to provide an air change of approximately 100 per hour over the furnace section, 60 per hour over the pouring floor, and 40 per hour in other portions of the building, an average volume of 10,000,000 cfm is removed from the entire open hearth building. This volume provides comfortable working conditions in all areas of the open hearth building, although the requirements are most severe.

---

rom the space and still have the ectrical portion isolated.

The hospital is modern throught. The operating rooms, for example, have a tile-like floor with etal strips in 6 in. squares that re grounded to prevent spark. The ght switches and other electrical nnections in the rooms are of the ercury type, thereby eliminating e possibility of a spark.

Air conditioning serves medical esearch, also, as evidenced by nother installation. Studies of iseased tissue, conducted in the athology laboratory at Louisiana tate University, are now carried n in all types of weather as the esult of air conditioning.

Installed in the "tissue room" here paraffin sections are preared, the equipment overcomes obtacles to continuous research that ere previously presented by excesively hot weather.

Describing the operation conducted in the laboratory, John R. Schenken, M.D., director of the pathology department, states:

> "We have to do with the study of tissue which is diseased. By the 'tissue room' we mean the room in which microscopic slides of tissue are prepared. In the preparation of microscopic slides it is necessary to embed tissue in paraffin which has a melting point of about 56 C. This paraffin then is cut in very thin slices measuring no more than 7/25,000 of an inch and mounted on slides. During very hot weather this procedure is quite difficult because the pieces cannot be cut off very well in the form of a continuous chain; in other words, as we use the term in the laboratory, 'paraffin ribbons'.
>
> "This unit enables us to continue our work at all times. Naturally, this comfortableness of the room has also increased the efficiency of our technicians during very warm weather. We are thoroughly 'sold' on the idea of air conditioning this type of laboratory."

The equipment in the laboratory consists of a portable air conditioning unit, installed by Higgins Industries, Inc., Carrier dealer.

SUPERCHARGER INVENTOR DISCUSSES GAS TURBINE

The gas turbine as an efficient prime mover is not yet here, but operating results of thousands of turbosuperchargers on American airplanes are paving the way to the higher temperatures needed for its development, according to Dr. Sanford A. Moss, General Electric Co. consulting engineer. However, whether the gas turbine will be able to compete with other types of prime movers when it arrives is a matter of speculation only, Dr. Moss adds.

This opinion on a much-debated subject was expressed by the 71-year-old inventor of the turbosupercharger used on U. S. airplanes in presenting a paper on Gas Turbines and Turbosuperchargers at the annual meeting of the American Society of Mechanical Engineers in New York City this month.

MAINTAIN MANPOWER

Maintenance of healthful and comfortable conditions in industrial plants is becoming more and more appreciated by both management and labor as essential to efficient production and vital in the "conservation" of our greatest national asset—manpower. Industrial hygiene involves many factors, with ventilation, heat removal, air cleaning and dust collection, and in some cases general air conditioning, playing important roles.

As an example of the "trend", a speaker at a recent meeting in Chicago cited a demand from workers for the complete air conditioning of a laundry, which demand was met by exhaust ventilation equipment to remove the heavy moisture load of the flat work ironers. This same speaker predicted that complete air conditioning of forge shops and foundries would be a big field in the postwar period.

The eighth annual meeting of the Industrial Hygiene Foundation, held in Pittsburgh last month, was devoted to the theme "maintain manpower". Text of the papers presented will be available in the Proceedings of the meeting, which may be ordered from the Foundation, 4400 Fifth Ave., Pittsburgh. Excerpts from some follow:

Some of the Highpoints of Industrial Plant Surveys

Excerpts from paper, Report on Highpoints of Foundation Plant Surveys, by Dr. F. R. Holden and W. C. L. Hemeon, Industrial Hygiene Foundation:

During the past year we have made over 40 field studies, each one requiring from two to 30 days. We have travelled over 30,000 miles.

Our surveys during the past year have dealt with a variety of exposures and include arsenic dust; lead dust and fumes; synthetic resin dust; free silica in the form of quartz, diatomaceous silica, and silica gel dust; trichlorethylene; fluoride fumes; hypochlorites; carbon tetrachloride; chlorine; sulfur dioxide; as well as excessive temperatures. It goes without saying that all plants involved are important to prosecution of the war. Many very toxic materials were found to be handled without any ill effects. One member company uses thousands of gallons of carbon tetrachloride in many places throughout their factory. However, by means of well planned exhaust ventilation, concentrations of that chemical rarely exceed 10 parts per million.

Skin diseases have been the most common occupational disease encountered during our surveys. In general the success in controlling dermatitis has been excellent.

The problem of determination of the free silica content of air borne dust recurs frequently in our work. It is an established fact that the dust thrown into the air seldom has the same free silica content as the parent material from which the dust originated. While there are several methods for determining the composition of such dusts, we have come to rely mainly upon X-ray diffraction analyses for that purpose. Both chemical and petrographic methods have given unreliable results at times. For example, an air borne dust containing clay with a known quartz content of 35 per cent was found to have only 2 per cent free silica by the petrographic method. An experience in one plant points up the im-

Industrial Hygiene Foundation hears papers and reports on health maintenance of men and plants at eighth annual meeting held in Pittsburgh last month

portance of checking the weights of cylinders of liquefied gases upon receipt. In the present case a cylinder, which was liquid full, exploded endangering the lives of nearby workmen. Investigation disclosed that the cylinder contained 18 lb more gas than permitted by law. When toxic gases are being used, no cylinder should be accepted which is leaking or which contains more chemical than is allowed by ICC specifications.

"Angel Eyes"

A new addition to the occupational disease jargon—"angel eyes"—derives its name from the corona effect observed when the workmen look at a light at night after excessive exposure to hypochlorite dust. The effect is caused by a slight edema of the cornea, the fluid acting as a prism.

One result of the war has been to greatly accelerate the production of silica gel, since that chemical is important as a hygroscopic agent and as a catalyst. We have had occasion to appraise health hazards in a plant manufacturing quantities of this material. It is curious that silica gel which is a hydrated form of free silica has shown no tendency to cause silicosis when applied experimentally to animals. Gardner's work, in fact, indicates that its effect is similar to that of inert dusts. We hope to develop data on human exposure to silica gel to confirm the results of animal exposure.

The fluoride problem has been encountered in much of our field work. In no case that we have studied has the exposure been sufficient to cause skeletal effects, but we have observed both skin irritation and nose bleeding.

Tests were conducted in a railroad tunnel prior to the undertaking of some repair work which would keep a number of workmen engaged for some days. Trains passed through the tunnel on an average once every 15 min throughout 24 hr of the day. The tunnel was ventilated, but it was important to determine definitely whether concentrations of carbon monoxide or sulfur dioxide would reach a point where they would endanger the workmen or interfere with the project. It was found that carbon monoxide did not exceed 50 parts per million at any time which is entirely safe for a complete working day, but concentrations of sulfur dioxide were in excess of acceptable concentrations and definitely objectionable. Accordingly, the workmen were supplied with chemical cartridge respirators for protection during the few days required for the job.

The methods of microanalysis of air used in industrial hygiene work are often usefully applied to other plant problems. One such application concerned extensive and serious corrosion of machine and metal products, the cause of which was unknown. With the aid of techniques applied to our more usual problems it was finally proven to be caused by hydrogen chloride from trichlorethylene degreasers. The trichlorethylene was of a poorly stabilized grade which decomposed releasing acid gas into the shop. It was possible to correct the condition by adopting a better stabilized solvent. Thousands of dollars in cleaning bills were saved by eliminating the cause of the corrosion.

Problems in general air pollution have occupied considerable attention in our field studies during the year. Sulfur dioxide, a potential killer of some vegetation when present in sufficient concentrations, and other chemicals, obnoxious in nature, have been the subject of some investigations. We anticipate that community air pollution by industrial dusts will receive wide attention after the war.

In one of our studies for measurements of the degree of contamination of a neighborhood by sulfur dioxide, we were able to indicate means, involving metering and controlled dilutions of the gas which would reduce its consumption to 5-10 per cent. This, obviously, would improve atmospheric conditions within the plant, widen the margin of safety outside, and simultaneously show a profit.

Fumes From Electric Furnaces

Widespread interest has appeared among our members in abatement of nuisance of fumes from electric furnaces. There are three practical methods available for the control of such fumes, each with advantages and disadvantages: (1) canopy hoods which are usually not applicable to the furnaces of smaller capacity or where the craneway is materially greater than 25-30 ft above the furnace. (2) A sufficiently large volume of general ventilation by means of propeller fans in monitors is also effective. (3) Application of local exhaust is the most desirable method wherein the fumes are removed at their source—the base of the electrodes and the firing door. This is by far the most efficient method of all since it requires very much less air flow than either of the other two.

Observations on Lung Changes in Electric Arc Welders

Excerpts from paper on Further Observations on Lung Changes in Electric Arc Welders, by Dr. O. A. Sander, member of medical committee, Industrial Hygiene Foundation:

Because of the tremendous increase in the use of electric arc welding in war production, it is desirable to review the available data on the effect of the fumes on the lungs and to determine if possible whether welders today are being adequately protected from excessive fume inhalation.

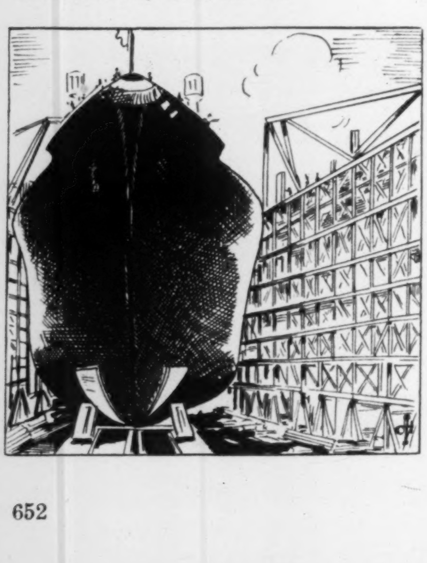
It has become quite generally recognized that both acute and chronic lung changes may occur when welders are exposed to highly concentrated fumes. The acute reactions have been studied at length in the past, especially the metal fume fevers, and will not be given any detailed consideration here. It is the chronic changes which have been recognized most recently about which there still appear to be doubts as to proper evaluation. Their visualization on chest roentgenograms has been of especial interest to the author since 1935, when we X-rayed our first group of welders showing these changes.

It should not be inferred that we feel that all welding is entirely innocuous as far as effect on the lungs is concerned. Quite the opposite, we know that exposure to highly concentrated fumes may be definitely harmful under certain circumstances, especially when they contain appreciable amounts of irritant substances, and certainly it is anything but pleasant for anyone to be working in dense clouds of any fumes for prolonged periods of time.

Summary and Conclusions

1) Electric arc welding which is done in large rooms and where the fumes are not allowed to concentrate excessively near the breathing level, does not cause any lung changes even after many years of work.

2) Excessive inhalation of concentrated fumes, especially in confined and unventilated spaces, may cause siderosis (iron deposits) in the lungs in from 6 to 10 years. The siderosis so produced consists only of inert iron pigment deposits in the lymphatics, without fibrous tissue proliferation and without progressive changes after exposure is materially decreased.



3) Electric welding or siderosis do not predispose to tuberculosis or other lung infection.

4) The siderosis of welding causes no functional impairment of the lungs and, therefore, no symptoms referable to the lungs.

5) Any respiratory involvement may be prevented in welding, even with the most confined work, if proper precautions are taken, either by adequate exhaust ventilation or positive pressure respirators, or both.

Control of Health Hazards in Shipbuilding, Including Welding

Excerpts from paper on Control of Health Hazards in Shipbuilding, Including Welding, by Philip Drinker, chairman, Industrial Hygiene Foundation's engineering committee; chief health consultant, U. S. Maritime Commission; member of HPAC's board of consulting & contributing editors:

Flash Burns

The term "flash" implies that the briefest of exposures to the welding arc will cause damage to the eyes. Actually we know that momentary exposures, excepting always the explosive type of reaction, do not cause flash burns. The offending radiations are, of course, the ultraviolet in which the welding arc is fairly rich. The resulting burn to the conjunctiva or whites of the eye is comparable to snow-blindness or sunburn. It makes itself felt as "sand in the eyes" some 6 hr after the exposure. It was shown in 1916 by Verhoeff and Bell that the effect on the eye of injurious radiations varies directly with the duration of the exposure and inversely with the square of the distance—that is, a 4 min exposure is twice as serious as 1 or 2 min, but an exposure at a distance of 3 ft is four times as severe as one at 6 ft. They showed also that the effects of short exposures over a single day were cumulative.

Using a typical welding set, we have shown recently that the severity of the dosage from any welding arc at any distance can be measured easily. Since dosage takes in both time and distance, it now is a simple matter to determine what protection is needed in order to prevent flash burns under any particular circumstances.

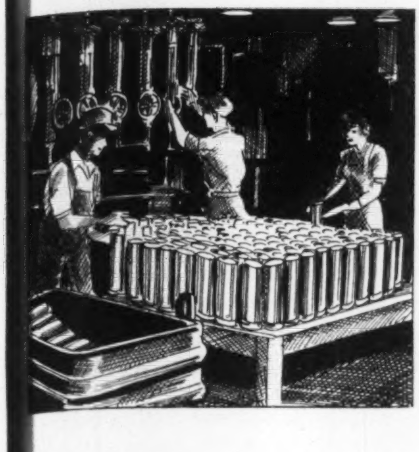
From the practical standpoint, safety goggles of clear glass, intended to protect against impact and equipped with sideguards, give all the protection needed against flash burns. They are sufficiently opaque to the ultraviolet rays from the welding arc to warrant their use as antiflash goggles. Furthermore, they can be worn on the night shifts when the tinted goggles make walking around shipyards far too difficult.

Illness From Breathing Welding Fumes

On freighters, tankers, landing barges, and troop carriers there is comparatively little welding of galvanized iron. On virtually all combat vessels, and especially those of light weight, there is considerable galvanized iron and much of this must be welded. All welders, shipfitters, and pipefitters have had some experience with metal fume fever, or zinc shakes, caused by breathing excessive amounts of zinc oxide fume. All yards now go to some pains to see that men welding galvanized plates are adequately protected by local exhausts, air masks, or both.

When iron is boiled in the electric arc its vapor is burned to form ferric oxide which is the color of rouge and is so distinctive we use it for measuring the pollution caused by welding steel. A small hand pump serves to draw a known volume of air through a white filter paper disc about 1 in. in diameter. The resulting discoloration is then matched against standards with results accurate to within about 15 per cent, which is close enough for field work.

Men working on jobs such as double bottom welding where ventilation has been inadequate may, after several months, develop a cough which wakes them in the



early morning. Sometimes the coughing produces traces of blood. Naturally this makes the men and their families fear something serious, especially tuberculosis. These men do not have any of the symptoms ordinarily associated with tuberculosis—they have no night sweats or afternoon temperatures, they do not lose weight, and their chests generally are normal by X-ray. If such men are shifted to jobs in which the welding fume exposure is slight, the cough soon disappears. Obviously the condition is preventable, and definitely it is transitory. A study of 864 cases of pneumonia among shipyard workers has been completed recently by Drs. Collen, Dybdahl and O'Brien of the Permanente Foundation Hospital, Oakland, Calif. Their findings show clearly that pneumonia is no more apt to occur among welders than among other workers in the shipyards. Both in severity and frequency it varies directly with the numbers employed. Also, this same paper shows that the individual's previous occupation and residence bear no relation to the incidence of pneumonia. New workers who have come to a shipyard from other parts of the country soon become acclimatized and, after a few months' residence in the new community, are neither more nor less susceptible to pneumonia than are the natives of the community.

Lead Poisoning in Shipyards

It is our usual practice to prime all metal surfaces of Maritime vessels with red lead, while the Navy requires priming with zinc chromate. In some yards the outside painting is done with spray gun, while in others virtually all painting, both inside and out, is done by brush. In general, spray painters are adequately protected with appropriate masks, but as all vessels are apt to be crowded during construction, it is very difficult to protect other workers from breathing paint mist.

Welding is supposed to be done only on unpainted surfaces. If steel plates are painted before being welded into place, a 6 in. margin is supposed to be left unpainted. Any paint, either lead or zinc, is boiled off by the temperature of the electric arc or the acetylene torch. When a welder is required to touch up some small job which has been rejected by the inspector, the welder will let the heat of the arc clean the paint off the metal instead of going to the trouble of scraping it off with a wire brush. We provide welders with respirators approved for use against lead fume, but in the rush to get ships built we have not been too successful in getting them used. However, the incidence of lead poisoning in our shipyards is very low.

A few cases of chrome sores were reported in one government yard spraying zinc chromate, but the trouble was eliminated as soon as the men had proper respiratory protection and has not occurred elsewhere so far as we know.

In burning or shrinking plates primed with zinc chromate, there is some irritation from the burning off of the paint film but the trouble is very easily eliminated by respirators approved for use against nuisance dusts such as silica.

Engineering Control Measures in Munitions Plants

Abstract of paper on Application of Engineering Control Measures in Munitions Plants, by Dr. A. D. Brandt, sanitary engineer, U. S. Public Health Service; safety and security branch, U. S. Army:

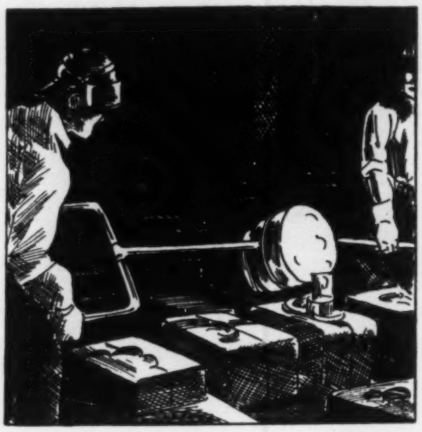
This discussion will be limited to the explosives processing plants of the Army since it is in these plants that most of our work has been done. In 1941, it became apparent that unusual problems existed in these plants as regards the application of the conventional engineering measures for the control of atmospheric contamination. The conditions which have been found to present most of the problems are (1) the explosive nature of the atmospheric contaminants; (2) the nature and location of many of the buildings housing the operations; and (3) the nature of the operations.

A study of these problems led to the conclusion that local exhaust ventilation systems for these plants must fulfill the following requirements if they are to be acceptable from both the industrial hygiene and safety viewpoints; (1) they must contain positive type exhausters such as centrifugal fans; (2) they must prevent the accumulation of explosive materials in the ducts and exhausters; (3) they must permit routine cleaning operations; (4) they must present a minimum of projections on the inside surfaces for the collection of the explosive contaminants; and (5) they must be properly grounded. The key to fulfilling these requirements centers on (2) since if it is met adequately the others are minimized and present no serious problems. Careful consideration of this requirement indicated that it could be accomplished either by locating an efficient collector (preferably wet) at each hood, or by keeping the inside surfaces of all ducts wet and wetting down the contaminant as well as possible by means of sprays.

Both of these systems have been tried and have been found to operate with complete satisfaction. Where systems with collectors have been used the collectors have been located adjacent to the hoods or intake grilles so that a large percentage of the contaminant is removed from the air before it enters the ducts or fan. Dry collectors are permitted only where the operation performed at or in the hood is such that a spark or detonation is highly improbable. It must be stressed, of course, that wet collectors are preferred and the dry collectors exist more or less under protest. Where wet collectors are used, the water supply and blower are so interconnected that the blower cannot be operated unless the water is turned on also.

In the other type of system which has been found satisfactory water sprays have been provided in each hood and all ductwork from the hoods to the sump slopes downward so that the water from the sprays drains to the sump. In addition to the sprays in the hoods which spray in the direction of air flow are several sprays located throughout the ductwork in an attempt to get a fair efficiency of contaminant removal and to keep the inside surfaces of the duct wet at all times. A water spray is located directly upstream of the fan and directed thereinto for the purposes of, first, washing the contaminant from the fan blades and housing, and, second, keeping any material collecting inside the fan so wet that it will resist detonation or combustion.

Another condition which presented new problems in this work is the size and location of many of the buildings housing the operations needing control measures. A fair percentage of the buildings in loading plants are small, of one room and usually one story type, within which only one operation is conducted. Others are larger but are divided into separate one room bays by means of barricades. The buildings are generally separated one from the other by considerable distances and many of the plants are located in flat, open terrain so that air movement is unobstructed. Consequently, in summer when the doors are open strong breezes are the rule through the buildings and the control velocities must be adequate to overcome the interference created by the natural air movements. Where the equipment requiring control measures is located near open windows natural air velocities as high as 1000 fpm have been experienced on windy days. Therefore, the control velocities normally recommended for similar operations are inadequate in these plants and a minimum control velocity of 350 fpm has been found necessary unless the source of contamination is protected by shields, barricades, or equipment. The individual rooms or bays usually house only a single operation which seldom presents more than two or three major sources of contamination; consequently, the unit system with hoods and collectors at the several sources of contamination tied to a common exhauster located outside the building provides a satisfactory solution.



Rotation of Jobs

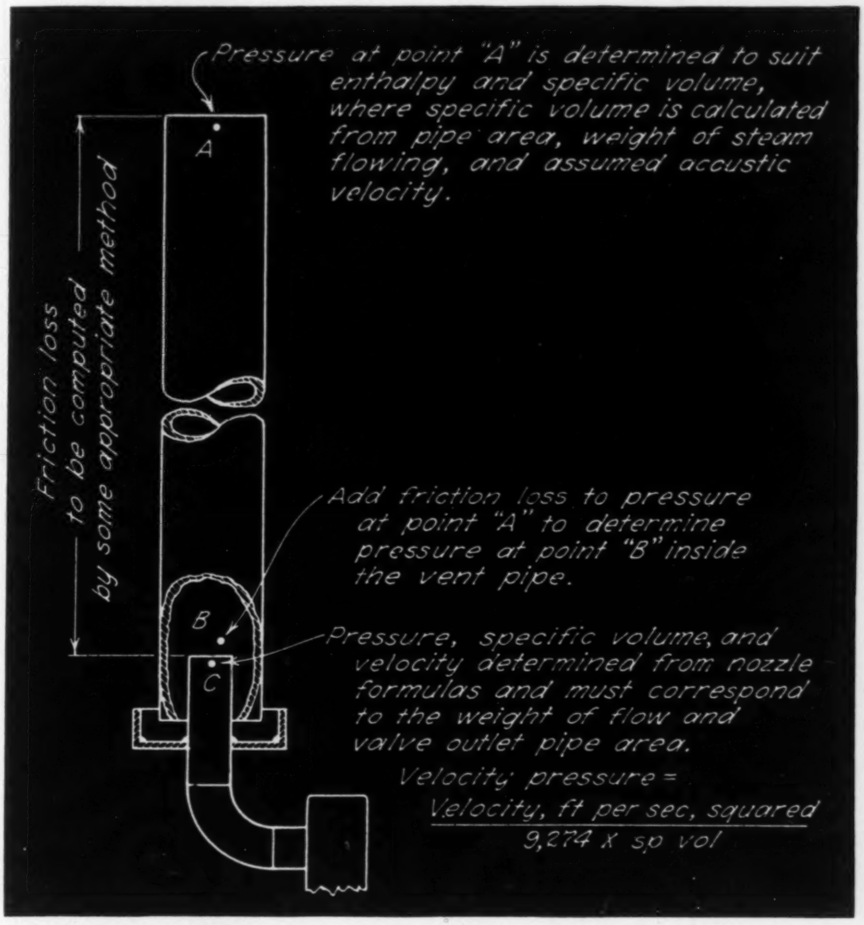
Many, if not most, of the operations in these plants require the attendance or exposure of only relatively few workers, so that it is sometimes difficult to justify the expenditure necessary for the installation of properly designed local exhaust ventilation systems. Consequently, many of the operations involving excessive atmospheric contamination are enclosed as much as possible, the operators at these jobs are rotated to other jobs involving less or no exposure, and respirators are required for the high exposures to avoid the relatively expensive procedure of installing local exhaust ventilation.

Some of the exposures, even though they are severe and would lend themselves well to control by local exhaust ventilation, are intermittent and of short duration. Consequently, the use of respirators during the periods of exposure appeared to be the most feasible, and certainly the most economical control method. However, this introduced a new health problem since most of the materials handled in these operations are severe dermatitis producers and the incidence of dermatitis on the faces of the wearers where the respirators came in contact was very high. This problem was overcome for the greater part by the use of facelets on the respirators and the frequent renewal thereof (sometimes as often as four times daily); by exceptional personal hygiene; and by appropriate protective creams. On the other hand, where intermittent exposures to high concentrations of TNT were involved, an additional complication arose since TNT is known to be absorbed through the skin. While respirators would effectively prevent the inhalation of TNT during intermittent exposure to even high concentrations, the exposed surfaces of the workers' bodies and their uniforms were found to be covered with a layer of TNT only a few minutes after beginning work at these operations. Adequate control of the contaminant by means of local exhaust ventilation would reduce tremendously the amount of TNT depositing on the worker and decrease the skin absorption considerably. Therefore, each operation at each plant was found to require individual study to arrive at the most satisfactory solution.

Inasmuch as most of the materials handled in loading plants are explosive, considerable effort in the form of vacuum cleaning of equipment, walls and the like and washing of the floors and walls is necessary to prevent even small accumulation of dusts or fumes on exposed surfaces. Vacuum cleaners of the portable industrial type are everywhere in evidence and are serving a very useful purpose in connection with cleaning of exposed surfaces. The usual type consists of a suitable exhauster with separator (chamber having mechanical filters of the cleanable tube type) located directly upstream of the exhauster and adjacent thereto. In many instances these cleaners have been tied in to permanent piping systems throughout the nearby rooms to which connection may be made with the flexible rubber vacuum hose for cleaning operations while the motor and exhauster are outside the building proper.

BUY MORE WAR
BONDS NOW

How to Design SAFETY VALVE VENT PIPING of the Umbrella Type



Pressure at point "A" is determined to suit enthalpy and specific volume, where specific volume is calculated from pipe area, weight of steam flowing, and assumed acoustic velocity.

Friction loss to be computed by some appropriate method

Add friction loss to pressure at point "A" to determine pressure at point "B" inside the vent pipe.

Pressure, specific volume, and velocity determined from nozzle formulas and must correspond to the weight of flow and valve outlet pipe area.

$$\text{Velocity pressure} = \frac{\text{Velocity, ft per sec, squared}}{9{,}274 \times \text{sp vol}}$$

Sketch of vent pipe arrangement showing the factors to be considered and criteria of satisfactory operation. In order to avoid blowback, the velocity pressure of the steam jet at point *C* must be equal to or greater than the calculated opposing static gage pressure inside the vent pipe at point *B*

SAFETY VALVE vent piping of the umbrella fitted type is one of those items of plant equipment that has been designed in past years by rule of thumb methods. There also are certain code requirements that must be met.

Since publication of the article on Sizing Vent Piping for Safety Valves [by Max W. Benjamin, Heating, Piping & Air Conditioning, October 1941, p. 615], several designers have become sufficiently interested in the matter to try the author's system in their own work. A few readers have had some questions about the method, and one case which was submitted for analysis is considered to be of general interest because it involves a question that has arisen several times.

In the following discussion, repetition of the material given in earlier articles is kept to a minimum; for basic information the reader is referred to those articles, or to text books dealing with the flow of fluids through nozzles and conduits.

Briefly, the suggested method of solution for all such problems is based upon well established facts concerning the flow of elastic fluids, coupled with the assumption that flow through a safety valve may be calculated as though the valve were a nozzle of poor efficiency. Examination of a cross section of a safety valve of modern design shows that from the inlet to the seat the valve is in fact a nozzle. Beyond the seat, however, the valve body has none of the contours of a good nozzle. Consequently the overall "nozzle efficiency" from inlet to outlet of such a valve must be low. By assuming low efficiencies it is possible to treat all safety valves as nozzles even though the usual nozzle contours may not have been used in the valve design. Limited test data available to the author indicate that the nozzle efficiency of a safety valve probably never should be assumed at over 30 per cent, while the conditions of installation and operation sometimes automatically establish much lower efficiencies.

The typical arrangement of safety valve and vent pipe with an umbrella fitting is illustrated in the accompanying sketch. The criterion for operation without discharging steam into the room is that the velocity head with which steam leaves the valve must be sufficient to overcome the difference between the pressure in the vent pipe inlet

Max W. Benjamin, Engineer, The Detroit Edison Co., Discusses Further the Practical Subject of Vent Pipe Design Rather Than Choice by Rule of Thumb Only

---

All republication rights are reserved.

and that of the surrounding atmosphere.

Acoustic Velocity Considerations

Difficulties that have arisen in the calculation of vent pipe designs stem from the fact that elastic fluids behave in certain characteristic ways and in some cases the rate of flow will be limited by the acoustic velocity, whereas in other cases it will not. In general, when an elastic fluid flows from a region of relatively high initial pressure into one where the pressure is less than about 50 per cent of the initial it is possible that an acoustic velocity limitation will obtain. However, the fact that a two to one pressure ratio exists does not *dictate* an acoustic velocity condition; it only indicates the possibility. Calculations must then be made to determine whether the acoustic velocity phenomenon applies or not. With long vent pipes a pressure ratio much larger than two to one is required before the acoustic velocity limit is reached, whereas with short vent pipes a pressure ratio close to two to one may invoke this phenomenon. Some discussion of this relationship may be found in the article How to Design Steam Piping for Maximum Capacity and High Pressure Drop [by Max W. Benjamin, Heating, Piping & Air Conditioning, September 1936, p. 475].

When the fluid flows at a steady mass rate (i.e., when the flow in lb per sec is constant) it is a fact that irrespective of the shape or cross sectional area of the conduit the product of velocity times area equals the product of mass rate of flow times specific volume. In equation form, $Av = wV$, where A = cross sectional area in sq ft, v = velocity in ft per sec, w = rate of flow in lb per sec, and V = specific volume in cu ft per lb.

If the area is given in sq in., a, and the rate of flow is in lb per hr, W, the equation becomes

$$\frac{av}{144} = \frac{WV}{3600}$$

and

$$\frac{W}{a} = \frac{26\,v}{V}$$

These equations hold in all cases of steady flow. However, when an elastic fluid expands in a conduit of uniform cross sectional area, such as a vent pipe, it is impossible for the velocity v to exceed the velocity with which a sound wave would travel in the fluid at the pressure and specific volume existing at the point where that maximum velocity occurs.* At this condition, nature so adjusts the pressure that the corresponding specific volume multiplied by the mass rate of flow is equal to the cross sectional area multiplied by the velocity of sound, thereby satisfying the above equations.

Sizing vent piping for steam safety valves is a problem which often may be solved successfully by the ASME boiler code requirements or by rules of thumb. There are, however, many situations where these rules are of doubtful value, and where such piping could be designed with more confidence if a rational basis were employed.

Such a method was described by Mr. Benjamin in the October 1941 HPAC; it is in part a practical application of the acoustic velocity limitations in the flow of elastic fluids through conduits of uniform cross sectional area. In addition to applying the acoustic velocity principle to the flow inside the vent pipe, the author introduced the idea that where an umbrella fitted vent is used it is necessary that the velocity pressure in the steam jet leaving the safety valve be at least equal to the static pressure inside the vent pipe. Not only have vent lines designed by this method proved satisfactory in operation, but tests on safety valve capacity have yielded incidental data on the vent piping which shows that the method is sound.

This month, further details of the method are given, the discussion answering some questions from readers of the earlier article.

Determining Pressure at Vent Outlet

Because of friction the static pressure in a pipe decreases in the direction of flow.† Therefore the lowest pressure in a pipe will be found at the outlet end. Furthermore, with elastic fluids, the specific volume increases as the pressure decreases and in a cylindrical pipe the velocity must increase to accommodate the increased specific volume. This increase in velocity occurs with a corresponding reduction of enthalpy according to the equation, change of velocity, ft per sec $= 223.7\sqrt{\text{change of enthalpy, Btu per lb}}$. Frequently the initial velocity is considered to be zero in which case final velocity $v = 223.7\sqrt{\text{change of enthalpy, Btu per lb}}$. However, when the expansion has taken place to the extent that the velocity of sound is reached it is impossible for any further reduction in pressure to occur even though the pipe were to discharge into a region of perfect vacuum.

If the calculations show that for a given weight of flow the acoustic velocity would occur with a vent outlet pressure greater than that of the surrounding atmosphere it may be taken as a fact that the actual outlet pressure will have the calculated value. This point seems to have been accepted by engineers who have studied the previous articles, but the condition next described has given trouble. If the calculations show that in order to have the velocity reach the acoustic value it would be necessary to have a specific volume corresponding to a pressure less than that of the surrounding atmosphere it then follows that the actual vent outlet pressure will be that of the atmosphere into which the pipe discharges and *not the calculated pressure.* In this case the calculated pressure (corresponding to acoustic velocity) is merely the lowest pressure that could possibly exist at the vent outlet even though the vent discharged into a perfect vacuum. Any lower pressure would correspond to a velocity higher than that of sound, which is thermodynamically impossible when expansion takes place within a conduit of constant cross sectional area. Thus, if the vent pipe discharges to atmosphere the pressure at its outlet end will be equal to or greater than atmospheric; it never will be less than atmospheric. The pressure corresponding to the acoustic velocity must be calculated merely to find out whether the vent outlet pressure will be greater than atmospheric.

---

*The velocity of sound may be calculated from the relation $v_s = 12\sqrt{gkpV}$ where v_s = velocity of sound in ft per sec; g = acceleration due to gravity = 32.2 ft per sec²; k = adiabatic exponent, = 1.13 for saturated steam, = 1.3 for superheated steam; p = absolute pressure in psi at the cross section where v_s occurs; and V = specific volume in cu ft per lb at the cross section where v_s occurs.

†If the fluid is introduced into the pipe with a velocity higher than that of sound a different state of affairs exists. In many actual vent pipe installations steam leaves the safety valve and enters the vent pipe at supersonic velocity, but in this system of design the pressure at the vent pipe inlet is calculated as though the entrance velocity were subacoustic. This assumption results in an error on the safe side.

Determining Pressure at Valve Outlet

As in the case of the vent pipe, it also is necessary to determine the outlet pressure of the safety valve. The valve is not considered to have an acoustic velocity limitation, however, but is treated as a nozzle. The valve outlet pressure, therefore, is a function of its capacity and efficiency. If calculations made with an assumed efficiency of, say, 30 per cent show that the outlet pressure is greater than that of the region into which the valve discharges it is in order to use the calculated pressure in subsequent calculations. On the other hand, if calculations made with the assumed efficiency produce a valve outlet pressure less than that of the region into which the valve discharges, it is indicated that the assumed efficiency is too high. In such a case the greater pressure of the discharge region exerts its influence to cause shock losses in the valve body so that the outlet pressure will be raised and the overall efficiency will be reduced.

The foregoing discussion may be summarized by saying that pressures less than atmospheric do not exist in a safety valve and vent system discharging to atmosphere. For high capacity systems using modern valves set at high pressure it is easily possible that both the valve outlet pressure and the vent outlet pressure may be greater than atmospheric. Both situations will now be illustrated, using the same valves and vent pipe but operating under two different pressure settings. The first case illustrates the solution for high capacity operation, whereas the second case is that of low capacity operation (which constitutes the actual problem submitted by a reader for analysis).

In both cases a battery of seven 6 in. safety valves, each with 8 in. outlet, discharge into a 24 in. diameter manifold and vent pipe having an equivalent length of 108 ft. Each valve discharges into the manifold through a short 10 in. diameter sleeve which is telescoped over the 8 in. valve outlet, thus forming the so-called "umbrella" connection.

High Capacity Operation

For the high capacity case it is assumed that the valves are to relieve saturated steam at an initial pressure of 250 psi gage. The manufacturer's rating under this condition is 150, 400 lb per hr per valve. The cross sectional area of each 8 in. valve outlet is 50.03 sq in. The cross sectional area of the vent pipe is 424.6 sq in.

Vent Pipe

1) Initial enthalpy of the steam at 250 psi gage = 1201.7 Btu per lb.

2) Assuming acoustic velocity of 1500 ft per sec at the vent pipe outlet the enthalpy drop = $(1500/223.7)^2$ = 45.0 Btu per lb and the enthalpy at the vent pipe outlet will be 1156.7 Btu per lb.

3) From $W/a = 25v/V$, the specific volume V at the vent outlet for the assumption of step 2 must be

$$V = \frac{25va}{W} = \frac{25 \times 1500 \times 424.6}{7 \times 150{,}400}$$
$$= 15.2 \text{ cu ft per lb.}$$

4) From steam tables or from Ellenwood and Mackey's Vapor Charts the pressure corresponding to 1156.7 Btu per lb and $V = 15.2$ cu ft per lb is 26.9 psi absolute = 12.2 psi gage.

5) As a check on the acoustic velocity assumed in step 2, one may calculate $v_s = 12\sqrt{1.13 \times 32.2 \times 26.9 \times 15.2} = 1463$ ft per sec.

6) Because this value of v_s does not check the assumption of step 2, it is desirable to make additional trials until reasonably good agreement is obtained. This comes out to be $v_s = 1470$

$V = 14.85$
$p = 27.7$ psi absolute
$= 13.0$ psi gage

7) Since the calculated vent outlet pressure is above atmospheric, the actual pressure will be that calculated, i.e., 13.0 psi gage.

8) The pressure rise from vent outlet to inlet may be computed by Fritzsche's formula and turns out to be about 6.7 psi.

9) Thus the pressure at the vent pipe inlet is 13.0 plus 6.7 = 19.7 psi gage. This establishes the pressure of the region into which the valves discharge.

10) If the system is to operate without blowback, the velocity head of the steam jet leaving the safety valve must be at least equal to 19.7 psi and some margin above this value is desirable.

Safety Valves

Calculations to be made for determining the velocity head of the steam jet leaving the valve involve a trial and error solution with an assumed nozzle efficiency of 30 per cent to determine whether the valve outlet pressure at which the equation $W/a = 25\ v/V$ is satisfied is greater or less than the calculated vent pipe inlet pressure. If the valve outlet pressure so calculated exceeds the vent pipe inlet pressure, the calculated value should be used, but if the valve outlet pressure calculated for 30 per cent efficiency is less than the vent pipe inlet pressure additional computations should be made for lower values of efficiency until an outlet pressure is obtained which is equal to the vent inlet pressure. Calculations assuming 30 per cent efficiency are as follows:

1) Assume a series of valve outlet pressures, as in column 1 of Table 1.

2) With a Mollier chart for

Table 1—Calculation of valve outlet pressure

(1) Assumed outlet pressure, psi a	(2) Available energy, Btu per lb	(3) 30% of available energy, Btu per lb	(4) Outlet velocity, ft per sec, v	(5) Outlet enthalpy, Btu per lb	(6) Outlet specific volume, V	(7) Outlet area, sq in., a
50	129.9	38.9	1395	1162.8	8.43	36.2
40	145.2	43.6	1477	1158.1	10.35	42.1
30	164.9	49.4	1570	1152.3	13.6	52.0
20	191.3	57.4	1694	1144.3	19.8	70.1
10	232.5	69.7	1865	1132.0	37.9	121.9

steam determine the available energy between 250 psi gage and each of the assumed valve outlet pressures, as in column 2 of Table 1.

3) The energy converted into velocity is taken as 30 per cent of the available energy as in column 3.

4) For each of the assumed pressures determine the steam velocity corresponding to 30 per cent nozzle efficiency from the relation

$$\begin{aligned} v &= 223.7\ \sqrt{0.3 \times \text{available energy}} \\ &= 223.7\ \sqrt{\text{column (3)}} \end{aligned}$$

These velocities are given in column 4.

5) The enthalpy of the steam at the valve outlet is obtained by subtracting 30 per cent of the available energy from the initial enthalpy of 1201.7 Btu per lb, i.e. outlet enthalpy = 1201.7 — column 3, with the results listed in column 5.

6) Specific volume of the steam is obtained from the steam tables by interpolation or from the Ellenwood and Mackey charts for the assumed pressure and corresponding enthalpy calculated in step 5. These specific volumes are given in column 6.

7) The outlet area that would be needed to satisfy the conditions of velocity and specific volume found in the above steps is computed from the equation $W/a = 25\ v/V$, or $a = WV/25v$. The required areas are listed in column 7. W is the valve capacity in lb per hr, which in this case is 150,400.

8) The actual outlet area of each valve is 50.03 sq in. By inspection it is found that the actual outlet pressure corresponding to this area would lie between 30 and 40 psi absolute. By means of additional calculations or by interpolation the actual outlet pressure for 50.03 sq in. outlet area is found to be 32 psi absolute or 17.3 psi gage with a corresponding velocity of 1550 ft per sec and specific volume = 12.81 cu ft per lb. Since this pressure is less than the 19.7 psi gage calculated for the vent pipe inlet it will be necessary to calculate for lower values of efficiency, as illustrated under the following subhead, Low Capacity Operation, until an outlet pressure of 19.7 psi gage is obtained. It is found that under this condition the efficiency is 24 per cent, the velocity $v = 1340$ ft per sec, and specific volume $V = 11.3$ cu ft per lb.

9) The velocity head is calculated from the relation velocity pressure $= v^2/9274V$, which for this case gives velocity pressure $= 1340^2/(9274 \times 11.3) = 17.1$ psi.

10) Since the velocity pressure is definitely less than the gage pressure at the vent pipe inlet it appears that steam would blow out through the umbrella fitting and the system would not be satisfactory. A larger vent pipe is indicated.

Low Capacity Operation

The problem submitted by a reader for analysis will be used to illustrate low capacity operation. In this instance the seven valves are to relieve a total of 143,000 lb per hr of saturated steam at an initial pressure of 24.3 psi gage and initial enthalpy of 1169.2 Btu per lb. Calculations for the vent pipe and valve appear similar to those for high capacity operation but the points of difference should be noted.

Vent Pipe

1) Initial enthalpy of the steam at 24.3 psi gage = 1169.2 Btu per lb.

2) Assuming acoustic velocity of 1500 ft per sec at the vent pipe outlet the enthalpy drop $= (1500/223.7)^2 = 45.0$ Btu per lb and the enthalpy at the vent pipe outlet will be $1169.2 - 45.0 = 1124.2$ Btu per lb.

3) From $W/a = 25v/V$, the specific volume V at the vent outlet for the assumption of step 2 must be $V = 25\ va/W = (25 \times 1500 \times 424.6)/143{,}000 = 111.2$ cu ft per lb.

4) From the steam tables or Ellenwood and Mackey's Vapor Charts the pressure corresponding to 1124.2 Btu per lb and $V = 111.2$ cu ft per lb is 3.24 psi absolute.

5) As a check on the acoustic velocity assumed in step 2, one may calculate $v_s = 12\sqrt{1.13 \times 32.2 \times 3.24 \times 111.2} = 1375$ ft per sec.

6) If additional trials are made to bring steps 2 and 5 into agreement it will be found that the acoustic velocity is 1390 ft per sec, $V = 103$ cu ft per lb and $p = 3.55$ psi absolute.

7) The calculated vent outlet pressure corresponding to the acoustic velocity thus is less than that of the atmosphere surrounding the vent outlet. *In such a case the acoustic velocity calculations have no significance.* The actual vent outlet pressure will be atmospheric, and the velocity at the vent pipe outlet will be less than the velocity of sound.

8) The pressure rise from vent outlet to inlet may be computed by Fritzsche's formula and is found to be about 0.35 psi.

9) Thus the pressure at the vent pipe inlet is 0 plus 0.35 = 0.35 psi gage.

10) If the system is to operate without blowback, the velocity head of the steam jet leaving the safety valve must be at least equal to 0.35 psi, and some margin above this value is desirable.

Safety Valves

Just as in the calculation for high capacity operation, a series of trial and error computations is needed to find the valve outlet pressure at which the outlet will be filled with steam flowing at a velocity corresponding to 30 per cent of the available energy between the initial pressure of 24.3 psi gage (39.0 psi absolute) and the outlet pressure. The procedure is exactly the same as outlined for high capacity operation. At the conclusion it is found that the valve outlet pressure, with an assumed nozzle efficiency of 30 per cent, would be only 3.85 psi **absolute.** This pressure cannot exist at the valve outlet, as previously explained.

Another series of trial and error calculations may then be made to determine the efficiency and outlet velocity for the valve when its outlet pressure is equal to the vent inlet pressure, i.e. 15.05 psi absolute. These calculations, which are illustrated in Table 2, involve the following steps.

1) Assume a series of overall efficiencies as in column 1 of Table 2.

2) The isentropic heat drop will be the same for all assumed efficiencies and is equal to the available energy between pressures of 39 psi absolute (saturated steam) and 15.05 psi absolute. This value is listed in column 2.

Table 2—Calculation of nozzle efficiency and outlet velocity for safety valve

(1) Assumed efficiency, %	(2) Available energy, Btu per lb	(3) Heat converted into velocity, Btu per lb	(4) Outlet velocity, ft per sec	(5) Outlet enthalpy, Btu per lb	(6) Specific volume at 15.05 psi a, cu ft per lb	(7) Required outlet area, sq in.
5	69	3.45	415	1165.55	27.3	53.8
10	69	6.90	586	1162.10	26.9	37.6
15	69	10.35	717	1158.65	26.7	30.5
20	69	13.80	828	1155.20	26.4	26.1
25	69	17.25	926	1151.75	26.1	23.1

3) The heat converted into velocity is equal to the assumed efficiency multiplied by the available energy of step 2, as tabulated in column 3.

4) The corresponding velocity given in column (4) is calculated from $v = 223.7 \sqrt{\text{heat converted}} = 223.7 \sqrt{\text{column 3}}$.

5) The enthalpy of the steam at the valve outlet is equal to the initial enthalpy minus the heat converted into velocity, as tabulated in column 5.

6) The specific volume corresponding to the enthalpy of step 5 and the outlet pressure of 15.05 psi absolute may be calculated from the steam tables, or read from the *Ellenwood* and Mackey charts. These volumes are listed in column 6.

7) The required outlet area is equal to $a = WV/25v$ as before. For each efficiency the corresponding area is listed in column 7.

8) By interpolation or additional trial calculations the efficiency, velocity, and specific volume corresponding to the actual area $a = 50.03$ sq in. are as follows:

$$v = 445$$
$$V = 27.2$$
Efficiency = about 6.5%

9) The velocity head in psi is determined as before from velocity pressure $= v^2/9274V$ and for this case velocity pressure $= 445^2/(9274 \times 27.2) = 0.785$ psi.

10) Since the calculated velocity pressure is about twice the calculated gage pressure at the vent pipe inlet it appears that the system would operate without blowback.

What the Calculations Indicate

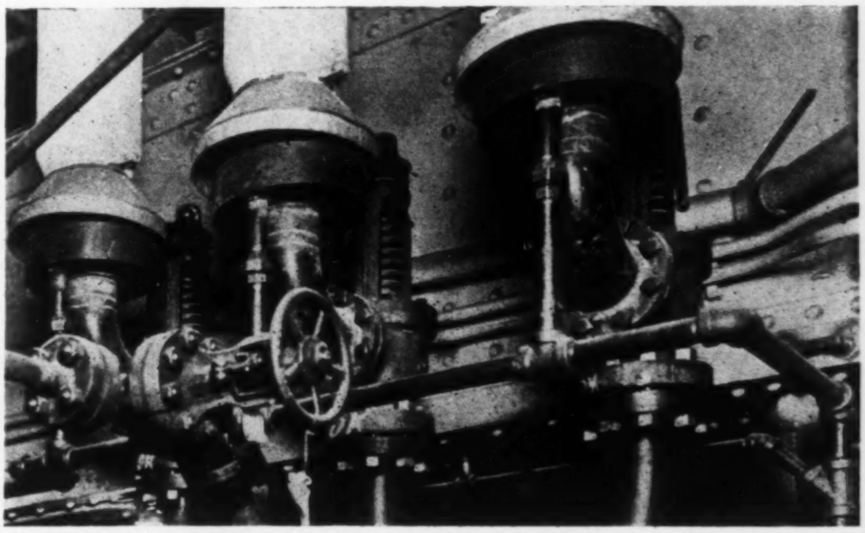
The calculations given above indicate that the 24 in. vent pipe is of adequate size for the low capacity operation but too small for high capacity operation. According to the codes, however, it is adequate for any case, since the codes merely call for a discharge pipe area at least equal to the combined outlet areas of the safety valves. In this instance the vent pipe area is 424.6 sq in. while the combined area of the valve outlets is $7 \times 50.03 = 350.2$ sq **in. Another** shortcoming of the code rule is that the length of the vent pipe is not taken into account, the code simply stating that the pipe should be as short and straight as possible.

If the vent pipe were attached to the valves with some sort of flexible connection there would be no concern over blowback. There are certain construction advantages with the umbrella fitting, however, particularly with large size valves. In all cases it assures freedom from stresses in the valves due to expansion of the vent pipe.

Another reader has proposed an interesting remedy for the situation illustrated by the case of high capacity operation. It is his suggestion that rather than to increase the size of the vent pipe it would be possible to improve conditions by reducing the size of the valve outlet. Whether this would be acceptable to the code bodies and manufacturers is open to question, but the possibilities may be observed from the calculations of Table 1. For example, assume that the valve had an outlet area of 42.1 sq in. instead of 50.03 sq in., corresponding to an outlet diameter of 7⅜ in. instead of 8 in. From Table 1 it is seen that for an efficiency of 30 per cent the outlet pressure would have to be 40 psi absolute (25.3 psi gage). Since this is greater than the 19.7 psi gage calculated for the vent pipe inlet the valve operation would then be independent of the presence of the vent pipe. Also from Table 1 the velocity would be 1477 ft per sec and the specific volume would be 10.35. From these values the velocity pressure would be $1477^2/(9274 \times 10.35) = 22.7$ psi which provides a margin of 3 psi over the velocity pressure required merely to balance the static pressure in the vent pipe. For this case the 24 in. vent pipe would be large enough.

How the actual efficiency would be affected by reducing the size of the valve outlet is unknown but it seems likely that smaller outlets could be fitted without serious detriment. At least it is a point which merits further consideration, particularly in cases where an installation is found to be unsatisfactory in operation.

It is hoped that this article will serve not only to clear up some of the questions that have arisen, but that it also may stimulate further interest in this rather fascinating subject.



View during construction showing safety valves and vent pipes on the saturated steam drum of a modern steam generator

• WPB . . . OPA . . . PAW . . . Etc. •

[*Also see p.* 158, *back section*]

SFA Regulation No. 10 Governs Bituminous Coal Distribution

Solid Fuels Administrator for War Harold L. Ickes announced November 18 the inauguration of a new bituminous coal distribution program designed to make currently available increased supplies of coal to meet the requirements of industrial and domestic consumers whose needs are urgent.

The program, which covers nearly all the bituminous coal produced in the eastern half of the nation, requires reductions in shipments of coal to industrial plants and railroads with large stocks in storage, thereby making available increased amounts of coal for shipment to retail dealers for domestic markets and to essential industries with insufficient coal supplies.

"Work stoppages at the mines combined with increasing coal requirements of war industries have created a shortage in the bituminous coal supply," Administrator Ickes said. "This new stock limitation program is being instituted to curtail shipments to industrial consumers with relatively large stocks so that eastern mines may supply, without numerous directions from the Solid Fuels Administration, the needs of industrial consumers with small stocks and at the same time provide increased amounts of coal for retail dealers who supply household consumers now dependent on bituminous coal.

"Standards for these stock limitations are set forth in a newly issued regulation (No. 10). Further voluntary action by producers and wholesalers and consumers to lower shipments below these standards wherever practicable will be helpful in meeting current heavy demands, which exceed the available supply, by making additional coal available during the coldest part of the winter."

Under the program, industrial plants and railroads having coal in storage equivalent to more than 25 days' consumption and public utilities having stored coal equivalent to more than 40 days' consumption must reduce their current orders for coal to 75 per cent or less of monthly burning requirements. However, because of the hazards of transportation, the program permits consumers supplied with coal from the producing areas affected, in the Dominion of Canada, and those supplied by tidewater in New York harbor and New England, to maintain an extra 15 days' supply above the 25 and 40 days' limitation.

The program provides that industrial plants, railroads, and utilities with stocks below certain specified days' supply may order enough coal to build up their storage piles to a safe and practical level within a few months. While none may order more than enough coal to bring their storage piles to these levels, plants and utilities with coal inventories below the standards may order their full month's requirements and from 30 to 40 per cent additional, depending on the number of days' protection represented by their stock piles.

Amendment to Oil Ration Order Aids Dealers in Balancing Accounts

Several changes in the fuel oil rationing regulations designed to bring dealers' fuel oil ration accounts back into balance, and at the same time to aid them in keeping the accounts in balance in the future, were announced October 30 by the Office of Price Administration, with the issuance of amendment 86 to ration order 11, effective November 1.

During the 1942-1943 heating season, the first under rationing, fuel oil suppliers and dealers in the rationed area incurred losses and shortages in their ration accounts which were not the result of their violations of the regulations. These losses and shortages were due to a number of reasons including, for example, failure of a consumer or dealer to pay his coupon account when credit was extended or failure to convert unit value coupons into exchange certificates before they expired.

Fuel oil dealers may now apply at their local war price and rationing boards to replace losses or shortages of fuel oil, and of evidences or delivery receipts for fuel oil which have accumulated since the beginning of rationing last fall. A procedure allowing primary suppliers of fuel oil to explain their legitimate losses, and thereby liquidate their "debts" to OPA, has also been established. At the same time a dealer must surrender excesses of fuel oil currency which he may have on hand for any reason, usually as a result of an oversight or other mistake.

To eliminate the chief cause contributing to fuel oil losses or shortages, provision is now made for cutting off ration credit to persons who are delinquent in settling their accounts. Under the revision a dealer or supplier may not extend ration credit on a delivery to a person who is 15 days or more in arrears from the date the coupons were due. A fuel oil purchaser who becomes overdue in payment of ration currency to his regular dealer may not purchase from any other source of supply on ration credit, OPA said. The order prohibits anyone from purchasing fuel oil on ration credit if he is 15 days in arrears to any supplier.

As a convenience to the industry, as well as another means of preventing future shortages, an oil dealer or supplier is now given the option of permitting a customer who has a ration bank account to submit a ration check for fuel oil purchases up to 15 days in advance of the date the oil is actually transferred. This provision will enable suppliers to handle sales to large industrial concerns more easily, thus avoiding a period of ration credit made necessary by the bookkeeping details which had to be handled before the actual ration check could be issued. A supplier may not use these advance payments, according to the order, until the actual transfer of the fuel oil has been made.

Order U-7 Reduces Gas Use in Appalachian Area

The Office of War Utilities acted last month to reduce natural gas consumption in the Appalachian area by ordering all industrial consumers who have facilities capable of burning residual fuel oil to operate those facilities to the limit to save gas during the coming winter. The order, general directive 1 of order U-7, prohibits delivery of natural gas to consumers in the area from November 15, 1943, to March 31, 1944, to the extent that their standby facilities will meet their fuel demands. The order applies only to residual fuel oil facilities.

Change in Order U-7 Simplifies Natural Gas Deliveries to Industrials

The Office of War Utilities acted November 11 to reduce further its volume of paper work by setting up automatic controls for delivery of natural gas to small industrial users who, heretofore, have had to make application for service on appeals.

The new procedure is set forth in administrative letter No. 3 under order U-7 and permits utilities to deliver natural gas to small users provided conditions set forth in the letter are met. Only small commercial and industrial consumers are affected.

Retailers Should Give Preference to Consumers with No Coal

The Solid Fuels Administration for War appealed last month to coal dealers and consumers to cooperate in an effort to alleviate suffering in homes and public institutions which may be without coal.

"Consumers who have coal are urgently requested to refrain from ordering more while their neighbors may be without any," Administrator Ickes said. "In some bituminous markets, there has been considerable pyramiding of orders by domestic consumers and surveys in certain areas show that many domestic consumers have sufficient stocks of coal to carry them through the winter. In these same markets, there are also many consumers who are without any coal and who have been unable to purchase sufficient fuel to keep their homes warm. These consumers should have first preference from retailers."

New Burners Replacing Old Ones Allowed Oil Rations

Fuel oil rations will be issued for use in new fuel oil burners, if the new equipment replaces wornout burners and results in increased efficiency, the Office of Price Administration announced November 6, with the issuance of amendment 87 to ration order 11, effective November 11.

This action was taken following the revision by the Petroleum Administration for War of its order prohibiting the delivery of fuel oil to any new oil burner. The change in its order allowed delivery of fuel oil for new equipment replacing inefficient burners.

It is felt that the increased efficiency of new home heaters will result in reducing consumption of fuel oil by consumers. Although the revision allows fuel oil for new burners which are to take the place of old or inefficient ones, no oil rations will be issued for new equipment in homes which previously did not have any oil burner. Oil rations cannot be issued to consumers buying new oil burners, who previously had no burner, because of the continued short supply of fuel oil.

Another section of the amendment brings the fuel oil regulations into conformity with recent PAW and WPB actions suspending the policy of requiring conversion of commercial and industrial equipment from heavy fuel oil to an alternate fuel. The recent WPB change eliminated the need for its director general for operations (which office no longer exists) to approve PAW recommendations denying fuel oil rations for convertible facilities. In effect, the revision of the WPB supplementary directive 1-0 gave PAW authority to order conversion whenever conditions might warrant such action. At the present time the government has suspended its policy of requiring conversion of fuel oil facilities.

Recent Amendments to OPA Fuel Oil Rationing Order

An index to amendments Nos. 1 to 50 to the fuel oil rationing order appeared on pp. 171-172 of the April HPAC. Amendments 51-60 were covered on p. 233, May; amendments 61-65 on p. 52, front section, June; amendments 66-71 on pp. 411-412, August; amendments 72-73 on p. 466, September; amendments 74-78 on p. 537, October; and amendments 79-82 on pp. 174-175, back section, November.

Amendment 83, effective October 15, removes the restriction against issuance of rations for convertible facilities. It provides that facilities in process of conversion on which substantial work had been done by September 24, 1943, to alter them to burn coal or wood, will not be granted a fuel oil ration unless the district director of OPA approves the applicant's claim that there is an inadequate amount of coal (or wood) available. Provision is made to allow the issuance of small interim rations (not exceeding 10 per cent of the allowable ration for the full 1943-44 heating year) by the boards to cover the period during which the application may be under consideration by the district director or, if the application is denied, until the completion of the conversion of the equipment to the use of coal, in cases where extreme hardship would otherwise result.

Amendment 84, effective November 2, eliminates the restriction against the issuance of rations for the generation of electric power imposed by amendment 50. It is in line with the action taken in amendment 83 respecting convertible facilities.

Amendment 85, effective October 21, provides for the rationing of used lubricating oil which had been excluded by amendment 56. It also provides that dealers and primary suppliers are required to keep their records of fuel oil transfers for a period of two years instead of one. They are also required to keep at their places of business all records and equipment needed to determine fuel oil on hand.

Amendment 86, effective November 1, establishes procedures whereby primary suppliers and dealers may take care of deficits or overages of ration evidences and bring their ration accounts into balance. The amendment contains an accountability clause which requires that a dealer shall be accountable for all fuel oil, coupons and other evidences, ration credits, delivery receipts and, if he is also a consumer, fuel oil deposit certificates received by him. It states that coupons and other evidences and delivery receipts received at or for a dealer establishment shall, at all times when the dealer is open to transact business, be retained by him at the establishment for which they were received, until they are surrendered in accordance with the provisions of ration order 11 or deposited in the appropriate ration bank account. The amendment states that primary suppliers or dealers may not make delivery on ration credit to a customer who is 15 days or more in arrears to him from date due in submitting evidences for fuel oil which has been transferred. It further provides that a consumer who becomes delinquent in submitting evidences to his regular dealer may not purchase on ration credit from another primary supplier or dealer if he is 15 days in arrears from the date due in payment of ration evidences to any other primary supplier or dealer. Provision is made that a primary supplier or dealer may, at his discretion, permit a consumer who is a ration bank depositor to submit a ration check for fuel oil purchased up to 15 days in advance of the date of the transfer of the fuel oil. Dealers may also make payment in advance to primary suppliers and other dealers in coupons and other evidences, as well as by ration checks, by as much as 15 days, at the option of the tranferror. Primary suppliers and dealers are forbidden to use the evidences or checks received from such advanced payment until actual transfer of the fuel oil has taken place and only to the extent of such transfer.

Amendment 87, effective November 11, provides that fuel oil rations will be issued for use in new fuel oil furnaces, provided the new equipment replaces wornout burners and results in increased efficiency. Another section of the amendment brings the fuel oil regulations into conformity with PAW and WPB actions suspending the policy of requiring conversion of commercial and industrial equipment from heavy fuel oil to an alternate fuel.

Amendment 88, effective November 1, provides restrictions on ration credit transfers in addition to those established in amendment 86, which prohibited further extension of credit to persons who are in default in certain ration evidences for more than 15 days, and which prohibited persons who are so in default from accepting any further credit transfers from any transferor. The new amendment provides that a person who knows or who has reasonable cause to believe that such a default exists may not extend credit to a customer so in default to any transferor. The amendment also clarifies the provisions concerning losses or shortages for which a primary supplier may submit an explanation with his monthly report. Amendment 86 established the nature of the losses or shortages for which a dealer may receive compensation and this amendment sets forth in parallel language the losses or shortages for which the explanation of a primary supplier may be accepted. Neither amendment 86 nor this amendment is intended to relieve a transferor of any obligation to collect ration evidences from his transferee within the prescribed time. The amendment also provides in explicit terms that a dealer or primary supplier may not transfer fuel oil to a person required to surrender ration evidences (and the person may not accept the transfer) unless that person has evidences on hand or ration credits in his bank equal to the amount of the fuel oil to be transferred. The amount on hand or in his bank account must be exclusive of the amount owed for any prior transfers or of the amount of outstanding ration checks.

• WPB . . . OPA . . . PAW . . . Etc. •

Class 1 and 2 Change Making Fuel Oil Coupons Now Invalid

Class 1 and 2 "change making" coupons for fuel oil, representing part of last year's ration, are invalid for all purposes beginning December 1, the Office of Price Administration announced last month, with the issuance of amendment 89 to ration order 11.

On September 30 the class 1 and 2 coupon sheets expired for consumers, but the fuel oil industry was allowed to use the change making coupons on these sheets an additional two months for restocking purposes.

The invalidation of these coupons means that fuel oil can no longer be transferred by the industry to anyone, and no exchange certificate will be issued to a dealer or primary supplier for such coupons. Neither may these coupons be deposited in ration bank accounts after that date.

Class 1 and 2 sheets, which included coupons with an indefinite value and change making coupons with a definite value, were used by the average householder last winter in buying fuel oil. This season they have been replaced by new class 4, 5, and 6 coupon sheets.

CMP No. 9A Gives Procedures For Obtaining Repair Materials

Procedures under which persons engaged in the business of making repairs may obtain controlled materials and other materials and parts have been established in a new CMP regulation No. 9A, the Office of Civilian Requirements announced November 26.

At the same time, an amendment to CMP regulation No. 9, governing retailers' acquisitions of copper wire, was announced. The new 9A permits persons engaged in any type of repair work to buy up to 20 tons of carbon and alloy steel, a total of 500 lb of copper and copper base alloy brass mill and foundry products, and 200 lb of aluminum in specified forms and shapes in any calendar quarter.

Special provision is made in the regulation to permit refrigeration repairmen, electricians, domestic appliance repairmen, electrical contractors, and radio repairmen to buy $150 worth of copper wire or one-eighth of what they used during 1941 (figured as accurately as possible by dollar volume), whichever is more. The regulation permits repairmen to buy as much other material as they need for maintenance and repair work. The amendment to CMP regulation No. 9 eliminates from that regulation provisions under which repairmen were formerly able to obtain copper wire, inasmuch as repairmen will now obtain wire under 9A.

To buy materials and parts under 9A, a repairman must put a certification in substantially the following form on his orders:

CMP Allotment Symbol V-3: Preference Rating AA-3 "The undersigned purchaser certifies, subject to the penalties of Section 35 (A) of the United States Criminal Code, to the seller and to the War Production Board, that, to the best of his knowledge and belief, the undersigned is authorized under applicable War Production Board regulations or orders to place this delivery order, to receive the items ordered for the purpose for which ordered, and to use any preference rating or allotment number or symbol which the undersigned has placed on this order."

Repairmen who do work for persons who have the right to use an AA-2x or higher preference rating to buy non-controlled materials and parts for their own maintenance and repair, may use their customers' ratings to buy what they need for repair or maintenance work or to replace inventory used for such purposes.

Special provisions are made in 9A for repairmen whose work is primarily of an industrial nature. WPB may authorize such repairmen to buy up to 2000 lb of copper wire and a total of 2000 lb of copper and copper base alloy brass mill and foundry products. They may also be authorized by WPB to use an AA-2 preference rating. Applications for such authority should be addressed by repairmen engaged principally in industrial repairs to War Production Board, Reference CMP regulation 9A, Washington (25), D. C. Application must be by letter and must (1) show what kind of work the repairman is doing and (2) what kind of customers he has.

If a repairman, industrial or other, requires more controlled materials in a quarter than he may get under 9A, he should fill out and send to WPB in Washington, a form CMP 4B. WPB may then allot additional controlled materials and assign him a preference rating. However, if a repairman gets an allotment, he may not use the provisions of 9A to purchase controlled materials, non-controlled materials, or parts.

The regulation specifically prohibits repairmen from fabricating repair parts that they intend to sell to others, rather than use themselves, with the materials that they obtain under the procedures it establishes.

Deliveries of materials may not be accepted if the inventory of the repairman accepting such deliveries would become in excess of a 60-day supply, except in the case of copper wire, with respect to which the inventory limitation is 15 days.

Attention is called to the fact that materials obtained under CMP regulation may not be used in violation of other regulations and orders of WPB, and that in any case where special application is required to obtain certain materials such applications must be filed in order to obtain them.

Despite the fact that the new regulation makes provisions for repairmen to obtain copper wire, the War Production Board calls their attention to the fact that certain types of wire will not be immediately available, inasmuch as military requirements for them still absorb the major portion of the supply. However, certain types will be immediately available and the procedure to obtain such types is now outlined in the new regulation.

Value of Fuel Oil Coupons Unchanged

Rations of fuel oil throughout the 33-state rationed area will remain unchanged at 10 gal per unit for period 2, which began November 30, Chester Bowles, administrator of the Office of Price Administration, announced last month. Period 3 coupons, which also went in effect on November 30 in the midwestern and southern states under fuel oil rationing, have been similarly given a 10 gal unit value.

The 10 gal "par" value was continued by OPA after consultation with the Office of Civilian Requirements and the Petroleum Administration for War. It means that supplies are available in sufficient quantity to meet the ration demand and therefore no reduction is necessary. However, the oil supply for civilians has not improved to an extent where an increase in the value of the coupons can be made, according to OPA.

Although period 2 and period 3 (for the midwest and south) coupons went into effect on November 30, coupons for the first heating period, which became valid last July, may be used until January 4 to buy fuel oil.

Price Schedule 88 on Petroleum Amended

The Office of Price Administration has provided that, on delivered container sales of less than 260 gal and on tank wagon sales, sellers automatically may add three-tenths of a cent a gallon to formula ceilings on fuel and heating oils "in any area where fuel oil rationing is required by the United States government or any agency thereof." The addition may also be made to specific cents-per-gallon ceilings except where a note is set forth with the listed ceilings that no further additions may be made by any seller. In these cases the stated ceilings already include the three-tenths of a cent.

The change is embodied in amendment No. 135 to revised price schedule No. 88 (petroleum and petroleum products) effective November 20, 1943.

Refrigerant Order M-28 Is Amended Again

Conservation order M-28, Dichlorodifluoromethane, as amended November 12, is designed to release restrictions on four refrigerant compounds formerly covered by the order and at the same time tighten restrictions on deliveries of dichlorodifluoromethane, or "freon-12."

In addition to the prohibition on delivery of "freon-12" for air conditioning systems used for comfort cooling and a few types of refrigerating systems, a new restriction is imposed which prohibits deliveries until April 1, 1944, for any other system except where it is operated under one or more of the operating conditions specified in the amended order.

Under the order, suppliers of "freon-12" at the retail level are permitted in general to make deliveries for civilian uses only. Military agencies will handle their own distribution. Producer's deliveries continue to be controlled by allocation directives, with monthly allocations dividing the available supply between military and civilian requirements.

Following is the amended order in full:

PART 1226—GENERAL INDUSTRIAL EQUIPMENT

[Conservation Order M-28 as Amended November 12, 1943]

DICHLORODIFLUOROMETHANE[1]

Section 1226.27 (Conservation Order M-28) as amended September 7, 1943 is hereby amended to read as follows: The fulfillment of requirements for the defense of the United States has created a shortage in the supply of dichlorodifluoromethane for defense, for private account, and for export; and the following order is deemed necessary and appropriate in the public interest and to promote the national defense.

§ 1226.27 *Conservation Order M-28*— (a) *Definitions.* For the purpose of this order:

(1) "F-12 gas" means dichlorodifluoromethane (sometimes called "freon-12").

(2) "Person" means any individual, partnership, association, business trust, corporation, governmental corporation or agency or any organized group of persons whether incorporated or not.

(3) "Producer" means any person engaged in the production of F-12 gas.

(4) "Supplier" means any person engaged in the business of distributing F-12 gas to persons using the same for installation in refrigerating or air conditioning systems. The term shall include an equipment manufacturer to the extent that he engages in the sale of F-12 gas which has not been installed in such systems. "System" means any "system" as defined in General Limitation Order L-38.

(5) "Equipment manufacturer" means any person who uses F-12 gas for charging new refrigerating or air conditioning systems or parts of systems manufactured by him. It does not include affiliates, subsidiaries, branches, divisions or sections of an enterprise, if not actually engaged in the manufacture of systems or refrigerant containing parts of systems.

(6) "Insecticide manufacturer" means any person who uses F-12 gas in the production of insecticide.

(7) "User" means any person who installs F-12 gas in a refrigerating or air conditioning system, other than an equipment manufacturer. It includes suppliers, service agencies, owners or lessees, to the extent that they engage in installing F-12 gas in any system.

(b) *Systems for which no deliveries are permitted.* (1) No person (including users, dealers, and other suppliers, and producers) shall deliver, or accept delivery of, any F-12 gas for use in, or for resale for use in any new or used system which is of a type referred to in List A.

(2) During the period from November 12, 1943, through March 31, 1944, no person (including users, dealers, and other suppliers, and producers), shall deliver, or accept delivery of, any F-12 gas for use in, or for resale for use in any new or used system of any type (not in List A) unless the system must be operated under one or more of the following conditions:

(i) Where an air cooled condenser is used and the ambient temperature is 110 F or higher; or

(ii) Where the saturated refrigerant temperature corresponding to the suction pressure is less than minus 10 F; or

(iii) Where aluminum or magnesium alloys or rubber have been used in construction of the system and come in contact with the refrigerant, and are not easily replaceable; or

(iv) Where the system is for use aboard ship or outside of the continental United States by the Army, Navy, Maritime Commission or War Shipping Administration; or

(v) Where the total operating charge required to operate the system is ten (10) pounds or less of F-12 gas and the system was in operation on November 12, 1943, and is used for food preservation; or

(vi) Where the use of Group 2 or Group 3 refrigerants, as defined in the American Standard Safety Code for Mechanical Refrigeration, ASRE Circular No. 15, ASA-B 9-1939, as approved by the American Standards Association April 20, 1939, is prohibited by that Code.

(The above restrictions apply not only to systems used for ordinary civilian purposes, but also to those owned, operated, or used within the continental United States by the Army, Navy, Maritime Commission or War Shipping Administration, including post exchanges and ships service stores, other than those used aboard ships.)

(3) Attention is called to paragraph (c) (2), which prohibits a supplier from delivering F-12 gas except on certified orders.

(c) *Deliveries by suppliers.* (1) No supplier shall deliver any F-12 gas to the following non-retail users, namely: The Army, Navy, Maritime Commission, War Shipping Administration, post exchanges, ships service departments and activities, equipment and insecticide manufacturers, for new or used systems, or for use in insecticide, without specific authorization from the War Production Board. Any supplier may deliver F-12 gas to any other person, for use in any new or used systems not referred to on List A of this order, if it must be operated under one or more of the conditions stated in (b) (2) (i) to (b) (2) (vi), both inclusive.

No person shall accept from a supplier any delivery of F-12 gas which is prohibited by the restrictions in this order.

(2) Whenever the owner of a system or any other user wishes to obtain F-12 gas for installation in a system or systems for which deliveries by suppliers are permitted under this order, he may place his order with any supplier for the minimum quantity, which the available cylinder or cylinders permit, necessary to bring the charge in the system or systems up to a normal operating charge. He must certify his order, or the vendor's delivery receipt, by a certificate endorsed on or attached to it, showing that the F-12 gas is to be used for such purposes only, and that he is not holding any empty cylinders not owned by him, which shall be in substantially the following form:

> The undersigned purchaser certifies to the seller and the War Production Board that he does not have any F-12 gas cylinders not owned by him, which have been empty for more than 15 days; and that the F-12 gas covered by this order will not be used or resold for any purposes not permitted by Order M-28.

Such certificate, which must be signed by the purchaser or his authorized official, will constitute a representation that what is stated in it is true. A supplier must not deliver any F-12 gas except under certified orders; and he must not make delivery under any order which is certified if he knows, or has any reason to believe that the certificate furnished with such order is untrue, incomplete, or inaccurate. In such a case the supplier must reject the order, and should explain why he is doing so, so that the prospective purchaser can comply with this order. Each supplier must keep all accepted orders and certificates which he receives, for a period of two years, for inspection by the War Production Board. (Certificates in the form required by this order before its amendment on November 12, 1943, may continue to be used for 30 days after that date, in place of the above form.)

---

[1] Formerly, Chlorinated Hydrocarbon Refrigerants.

This restriction shall not prevent a person who services several systems for which deliveries are permitted by this order from purchasing a cylinder of F-12 gas from a supplier, if the amount purchased is the smallest quantity practicable considering the sizes of the standard commercial cylinders and the amount needed in his current operations.

(3) No "standby charge" or any other quantity of F-12 gas, over and above that needed to bring the total charge in a system or systems up to the normal operating charge, shall be delivered to or accepted by any person for use in a system which he owns, leases, or operates (except the Army, Navy, Maritime Commission or War Shipping Administration): except, however, that a "standby charge" may be maintained for a system which is operated primarily for one of the following purposes: air conditioning or refrigeration for the production and storage of penicillin, or blood serum; or refrigeration for the storage of blood for plasma, or the production or storage of blood plasma.

(d) *Deliveries by producers.* Each producer shall hold his entire inventory of F-12 gas, together with all additional quantities produced or otherwise obtained by him from time to time, for delivery under such orders and for such uses as may be authorized or directed from time to time by the War Production Board. No deliveries of F-12 gas shall be made by a producer except pursuant to specific authorizations or directions heretofore or hereafter issued by the War Production Board.

(e) The provisions of this order shall be followed by every producer, contract agent, supplier, user, equipment manufacturer, insecticide manufacturer, and any other person buying, selling or delivering F-12 gas, without any regard to any preference ratings which have been assigned or which may hereafter be assigned to particular contracts or orders.

(f) *Miscellaneous provisions*—(1) *Applicability of regulations.* This order and all transactions affected thereby are subject to all applicable regulations of the War Production Board, as issued and amended from time to time.

(2) *Reports*[2] (i) Each equipment manufacturer who wishes to secure delivery of F-12 gas during any month for charging systems or parts produced by him, or for factory repair and charging of sealed or hermetic condensing units, shall file with the War Production Board, on or before the 15th day of the preceding month a report on Form WPB-3326, prepared in accordance with the instructions for such form.

(ii) Any person wishing to secure F-12 gas during any month, for use in insecticide, or for the manufacture or testing of any equipment other than refrigeration or air conditioning systems or parts, shall file with the War Production Board, on or before the 20th day of the preceding month, a report by letter, in triplicate, showing the minimum amount required for the month, the purpose for which required, and the amount used during the preceding calendar month for that purpose.

(3) *Violations.* Any person who willfully violates any provisions of this order, or who, in connection with this order, willfully conceals a material fact or furnishes false information to any department or agency of the United States is guilty of a crime, and upon conviction may be punished by fine or imprisonment. In addition, any such person may be prohibited from making or obtaining further deliveries of, or from processing or using, materials under priority control, and may be deprived of prioritie assistance.

(4) *Appeals.* Any appeal from the provisions of thi order, or any direction thereunder, shall be made by filin a letter in triplicate, referring to the particular provisio appealed from and stating fully the grounds of the appeal

(5) *Communications.* All reports to be filed and othe communications concerning this order should be addresse to: War Production Board, General Industrial Equipmen Division, Washington 25, D. C., Ref. M-28.

Issued this 12th day of November 1943.

WAR PRODUCTION BOARD

LIST A—SYSTEMS FOR WHICH NO DELIVERIES ARE PERMITTED

Air conditioning systems. Any system, of any size operated or installed for the purpose of lowering the temperature and/or humidity of air in any building, room o other enclosure used as, or located in any of the following:

Amusement parks.
Animal hospitals.
Auditoriums.
Ballrooms, dancing studios and dance halls.
Bank and loan associations.
Bars, cocktail lounges, and beer parlors.
Bowling alleys.
Concert halls.
Funeral parlors.
Golf clubs, country clubs, athletic clubs, and all other club and club houses.
Hotels and apartment houses.
Moving picture houses.
Night clubs.
Office buildings and offices, public or private.
Railway, streetcar and bus stations and terminals.
Residential buildings and dwellings of all kinds.
Restaurants, cafeterias, and other places selling meats, food or beverages.
Schools.
Service establishments, such as laundries, cleaners an dyers, tailor shops, barber shops, "beauty" parlors, automobile sales and service shops, and repair shops of al kinds.
Skating rinks.
Stores, selling any kind of products, material or merchandise, at retail or wholesale (excluding manufacturing establishments).
Studios of all kinds.
Theaters.

This list does not include (i) any such system used primarily to air condition a building, room or other enclosure used chiefly for purposes not listed above, or (ii any system designed, necessary and used, in substantia part, for the refrigeration and storage or processing o food, ice, or other materials or products necessary to li or health, or to be delivered to the Army, Navy, Maritime Commission or War Shipping Administration, and requiring refrigeration, temperature control, or freedom from dust or other impurities.

Refrigeration systems.

Skating rink systems.
Refrigeration systems solely for storing or dispensing carbonated or malt beverages.

PART 1226—GENERAL INDUSTRIAL EQUIPMENT
[Revocation of Interpretation 1]

Interpretation 1 of *Conservation Order M*-28, issued July 29, 1943, is revoked.

Issued this 12th day of November 1943.

WAR PRODUCTION BOARD

Amendment to Limitation Order L-211 Issued

The War Production Board issued November 27 a amendment of schedule 13 of limitation order L-21 to make clear that all kinds of piping and tubing used fo structural or mechanical purposes are not covered by th schedule.

---

[2] The reporting requirements of this order have been approved by the Bureau of the Budget in accordance with the Federal Reports Act of 1942.

Heating·Piping and Air Conditioning

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

50th Annual Meeting

January 31 - February 1-2

New York

DECISIONS THAT will have a vital influence on future Society activities will be made at the 50th Annual Meeting of the Society, to be held January 31, February 1 and 2, 1944, at Hotel Pennsylvania, New York, N. Y.

The meeting will open with a Business Session on Monday, January 31, and the Annual Reports of Officers and Committees will be presented. It is expected that a report will be made by a special Council Committee appointed November 1, to study the problem of relocating the Society's Research Laboratory. Another important report will be made by the Chapter Development Committee appointed at the Annual Meeting of the Society last January, and which has recently conducted a survey on a proposal that all Society members be assigned to chapters and that financial support of chapters be given by the national organization.

Amendments to the By-Laws and the Regulations Governing the Committee on Research will be presented for approval.

The Statue of Liberty on Bedloe's Island

Height—301 ft 3 in.; right arm 42 ft long; 40 persons can stand in the head of Statue at one time; the Statue was presented to United States by the French in 1883; Sculptor, August Bartholdi. Statue is open daily from 9 a.m. to 5 p.m. Boat leaves Battery for Bedloe's Island every hour on the hour. Travel via 7th Avenue Subway marked South Ferry from Station in Pennsylvania Hotel.

⁂

R. A. Wasson
President
New York Chapter

M. F. Blankin
President
ASHVE

Alfred J. Offner
General Chairman
Committee on Arrangements

NEW YORK IN EVENING DRESS – VIEW FROM ROCKFELLER CENTER

Night view from Rockefeller Center showing New York in evening dress

TENTATIVE PROGRAM

Hotel Pennsylvania **New York, N. Y.**
January 31-February 1-2, 1944

Sunday, January 30

10:00 a.m. Meeting of 1943 Committee on Research

1:00 p.m. Registration

1:30 p.m. Council

4:00 p.m. Conference of Chapter Delegates

Monday, January 31

8:30 a.m. Registration

9:30 a.m. BUSINESS SESSION
Greetings
Anniversary Messages from other Organizations
Introduction of Guests
Reports of Officers and Council
Report of Chapter Development Committee, W. A. Russell, *Chairman*
Report of Committee on Research, C. M. Ashley, *Chairman*
Report of Guide Publication Committee, P. D. Close, *Chairman*
Amendments to By-Laws
Report of Tellers of Election

12:30 p.m. Get-to-gether Luncheon

2:00 p.m. TECHNICAL SESSION
The Theories and Practices of the Past Fifty Years in Heating and Ventilation, by S. R. Lewis
Panel Discussion: The Future Trends of Heating, Ventilating, and Air Conditioning.

Tuesday, February 1

9:00 a.m. TECHNICAL SESSION
Review of the Development of Standards for Comfort Air Conditioning, by Lt.-Comdr. F. C. Houghten
Mathematical Analysis of Heat Distributio in Finned Surfaces, by W. H. Carrier
The Control of Air Streams in Large Spaces, by G. L. Tuve and G. B. Priester

2:00 p.m. TECHNICAL SESSION
Intermittent Heating and Ventilating o Large Churches, by F. E. Giesecke.
The Axial Flow Fan and Its Place in Ventilation, by W. R. Heath and A. E. Criqui

7:00 p.m. Testimonial Dinner to Past Presidents o ASHVE

Wednesday, February 2

9:00 a.m. TECHNICAL SESSION
Discoloration Methods of Rating Air Filters, by F. B. Rowley and R. C. Jordan
Army Fuel Requirements and Conservatio Methods, by B. F. McLouth.

12:30 p.m. Organization Meeting Committee on Researc

2:00 p.m. TECHNICAL SESSION
Optimum Surface Distribution in Panel Heating and Cooling Systems, by B. F. Rabe and F. W. Hutchinson
Unfinished Business
New Business—Resolutions
Installation of Officers
Adjournment

7:00 p.m. ANNUAL BANQUET
Presentation of Past President's Emblem t M. F. Blankin
Presentation of F. Paul Anderson Medal

Thursday, February 3

10:00 a.m. Organization Meeting of Council

•

New York Public Library, Fifth Avenue and 42nd Street, showing Empire State Building in distance

Second largest library in America, with two and a half million books; built in 1911 at a cost of $9,000,000, and designed by Carrere and Hastings, architects; the Library was developed from the consolidation of the Astor and Lenox libraries and the Tilden Trust in 1895; operating expenses of the central building are paid from the principal fund of the Library of $44,000,000; the 51 branches and 11 sub-branches are maintained through municipal appropriations. The building also contains Art Galleries of fine paintings and prints.

•

WISDOM SEAT - PUBLIC LIBRARY

Five Technical Sessions will follow the Business Session, and the papers offered will cover such interesting subjects as, Theories and Practices in the Past 50 Years in Heating and Ventilating, Intermittent Heating and Ventilating in Churches, Control of Air Flow, Heat Distribution in Fin Surfaces, and Distribution of Surfaces for Panel Heating and Cooling, Fuel Conservation.

The Program Committee has scheduled a Panel Discussion for Monday afternoon.

The research work of the past year will be reviewed by Chairman C. M. Ashley, in his report to the members, and as 1944 marks the 25th anniversary of the establishment of the Society's Research Laboratory, this Silver Anniversary will be fittingly commemorated. It is interesting to note that the first suggestion for the establishment of a Research Laboratory by the Society was made by a Charter Member, J. J. Wilson, in a communication published in October 1894, which is reproduced herewith from the magazine *Heating and Ventilation.* The report of the Committee to Establish a Research Bureau was made at the Society's 24th Annual Meeting in January 1918, and action by the Society to create a laboratory at the Bureau of Mines in Pittsburgh was taken at the 25th Annual Meeting in January 1919, at which time the first Committee on Research, consisting of 15 members, was selected.

As the Laboratory enters its 25th year it has established an enviable record in preparing fundamental data to solve engineering problems in the field of heating, ventilating and air conditioning. During that period Society members have furnished a substantial amount of the total funds to finance the research investigations that have been carried on. The industry has responded generously to requests of the Committee on Research for support, and the data developed have received world-wide recognition.

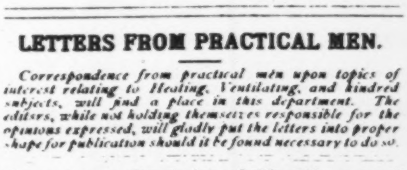
The Society is indebted to many of the old timers who conceived the Laboratory and carried it through its formative years.

The 50th Annual Meeting is, therefore, a combined Golden and Silver Anniversary at which history will be made.

Chairman John F. Collins, Jr. will preside at a meeting of the Chapter Delegates and in accordance with the requirements of the Constitution and By-Laws a meeting of the Nominating Committee will be held. Chapter Secretaries are required to certify Nominating Committee Representatives and Alternates before January 1st.

The Committee on Arrangements is taking every precaution to provide for the comfort of members who attend the 50th Annual Meeting. Because of the present conditions faced by transportation lines and hotels the Committee emphasizes the following:

1. Make hotel reservations 30 days in advance but not later than January 20; otherwise, the headquarters hotel may not be able to provide the kind of rooms that are requested.
2. When making hotel reservations indicate the approximate hour of arrival and if original date is changed it



LETTERS FROM PRACTICAL MEN.

Correspondence from practical men upon topics of interest relating to Heating, Ventilating, and kindred subjects, will find a place in this department. The editors, while not holding themselves responsible for the opinions expressed, will gladly put the letters into proper shape for publication should it be found necessary to do so.

American Society of Heating and Ventilating Engineers.

I had the pleasure of attendiug the meeting for organizing the American Society of Heating and Ventilating Engineers, and there met the gentlemen who endeavor on all occasions to make matters warm for their clients. I was much impressed with the vim and earnestness displayed to advance the cause of the society. I write to offer a suggestion for the consideration of those who may attend the next meeting. I believe it would redound to the benefit of all if a siaking fund were created for the purpose of equipping a laboratory with necessary apparatus, so that standard data could be obtained on the many points of the different systems of heating, and experiments made for the benefit of members. This would also be conducive to giving a high value to such data emanating from this society, and would be beneficial in many ways. An official seal, emblematic of the work of the society, to stamp all official papers, should be adopted, and later on, if desired, an official badge button, a facsimile of the official seal, could be issued to members. There is no doubt but that every member can at the next meeting furnish ideas which will be beneficial and help to advance the cause of this society. Its purpose and business aims place it in the front rank of modern progression. I predict for it a high place among the engineering societies of the world. J J. Wilson.

50th Annual Meeting
COMMITTEE ON ARRANGEMENTS

Alfred J. Offner, *General Chairman*

***Honorary Chairmen*—Homer Addams, W. H. Carrier, W. H. Driscoll, W. L. Fleisher, D. D. Kimball.**

***Vice-Chairmen*—R. H. Carpenter, J. C. Fitts, W. E. Heibel, C. S. Koehler, Capt. A. E. Stacey, Jr., R. A. Wasson.**

***Banquet*—Alfred Engle, *Chairman;* Russell Donnelly, *Vice-Chairman;* E. E. Ashley, R. W. Cumming, M. C. Giannini, Joseph Wheeler, Jr.**

***Finance*—W. M. Heebner, *Chairman;* H. W. Fiedler, *Vice-Chairman;* R. R. Ferguson, G. E. Olsen.**

***Hospitality*—H. S. Wheller, *Chairman;* W. J. Olvany, *Vice-Chairman;* T. N. Adlam, F. E. W. Beebe, H. H. Bond, Ernst Graber, E. B. Johnson, C. A. Miller, L. L. Munier, J. R. Murphy.**

***Inspection*—C. S. Pabst, *Chairman;* P. B. Gordon, *Vice-Chairman;* H. L. Alt, J. A. Heller, M. H. Hirsch, F. D. Lawrence, Rudolph Pollak.**

***Ladies*—Mr. and Mrs. H. J. Ryan, *Co-Chairmen;* H. S. Johnson, Mrs. R. H. Carpenter, Mrs. H. W. Fiedler, Mrs. W. L. Fleisher, Mrs. O. E. Frank, Mrs. A. V. Hutchinson, Mrs. C. S. Koehler, Mrs. G. E. Olsen, Mrs. R. A. Wasson.**

***N. Y. Chapter Special Committee*—C. F. Roth, *Chairman;* J. G. Eadie, J. C. Fitts, C. S. Hoffman, H. C. Meyer, Jr., G. M. Scott.**

***Publicity*—R. V. Sawhill, *Chairman;* Clifford Strock, *Vice-Chairman;* A. A. Bearman, C. H. B. Hotchkiss, O. O. Oaks, W. J. Osborn.**

***Sessions*—E. J. Ritchie, *Chairman;* C. H. Flink, *Vice-Chairman;* E. E. Adams, S. R. Apt, Thomas Baker, P. G. Griess, G. D. Guler, C. R. Hiers, H. P. Waechter.**

***Special Events*—A. C. Buensod, *Chairman;* A. F. Hinrichsen, *Vice-Chairman;* V. J. Cucci, C. A. Fuller, F. D. McCann, M. F. Rather, H. J. Rose, W. A. Sherbrooke.**

is important to advise the hotel promptly.

3. All uncalled for reservations are automatically canceled at 9:00 p.m. so that reservations can be held for later arrival only when hotel is advised.
4. When making reservations members should indicate their identity with the ASHVE.
5. In making hotel room reservations on the special cards provided, members should indicate first and second choice of accommodations.
6. Railroad reservations to New York should be made preferably, two to three weeks in advance of the meeting and pullman accommodations for both going and return trips should be obtained.
7. Whenever possible, travel on off-hour trains as the popular trains are always crowded.

Travel with minimum amount of personal baggage.

New York is adequately served by airlines and railroads with Pennsylvania, Lehigh Valley, C. and O., Southern, Seaboard, Atlantic Coast Line, and Long Island Railroads arriving at Penn Station, adjacent to meeting headquarters in Hotel Pennsylvania. New York Central and New Haven trains arrive in Grand Central Terminal, and B. and O. trains have bus connections to the 33rd St. Terminal near Pennsylvania Hotel. Trains of the Erie Railroad, D., L. and W., Central Railroad of New Jersey, West Shore and Ontario and Western have Jersey City terminals with convenient tube and bus connections to midtown New York.

R. A. Wasson, president of New York Chapter, says that the local membership anticipates with pleasure the visit of Society members from all parts of the country, and extends a warm welcome to those who are planning their trip to the golden anniversary meeting of the Society. A. J. Offner, General Chairman of the Committee on Arrangements, advises that the Committee is preparing a program that will be appropriate for this period and will be of educational value to every engineer in his wartime activities. There will be many distinguished speakers.

COUNCIL REVIEW

At the November 1 Council meeting of the Society in Indianapolis, 13 of the 18 members were in attendance, and among the important actions were: the establishment of dues rates for 1944 on the same basis as 1943; the adoption of the 1944 budget to conform to the new fiscal year of the Society authorized by a vote of Society members at the January Meeting in Cincinnati; recognition of the services of two of the headquarters staff for a period of 20 years; approved the Program for the 50th Annual Meeting; authorized the Award of the F. Paul Anderson Medal at the 50th Annual Meeting; and approved a new procedure for handling ASHVE codes and standards.

An enlarged program of research was proposed by the Research Executive Committee, and the Council authorized a special committee consisting of M. F. Blankin, Philadelphia, Pa., President of the Society; C. M. Ashley, Syracuse, N. Y., Chairman of Committee on Research; John F. Collins, Jr., Pittsburgh, Pa., Chairman of Finance Committee; and E. N. McDonnell, Chicago, Ill., Chairman of Executive Committee, to study the various proposals for the relocation of the Society's Research Laboratory.

Life membership for eligible candidates was approved and a list of members in arrears was referred to the Chapter Relations Committee for report.

1944 DUES RATES

The 1944 dues rate for all members except those in the armed service shall be as follows: For the calendar year 1944 *Initiation Fees* for Members and Associates shall be $10, Juniors $5, Students, nothing; *Annual Dues* for Members and Associates shall be $15, Juniors $10 and Students $3. That dues of new members be pro-rated quarterly from date of notification of election.

Former members who resigned in good standing can be reinstated upon application and payment of pro-rated dues for 1944 and the reinstatement of former members who were dropped for non-payment of dues, will be effective upon payment of reinstatement fee of $18 plus pro-rated dues for 1944. Candidates previously dropped for non-affiliation but who had paid an Initiation Fee can be reinstated upon payment of pro-rated dues for 1944.

A Study of Intermittent Heating of Churches

By F. E. Giesecke,* College Station, Tex.

THE FOLLOWING study is intended to aid in developing a systematic method of determining what percentage should be added to the capacity of a heating system designed for continuous heating in order that it might be used successfully for intermittent heating.

The study is difficult because the heat requirements of intermittently heated buildings vary with (1) the prevailing minimum outdoor temperature, (2) the interval between heating periods, (3) the construction, form, and size of the building, and (4) the length of the heating-up period.

For the first example to be studied, the small and simple church shown in Figs. 1, 2, and 3 was selected and the study limited to the auditorium. The study was based on the following assumptions:

1. The outdoor temperature was zero and remained constant at that temperature during the heating-up period.
2. The indoor air temperature was 32 F at the beginning of the heating-up period and was raised from 32 F to 70 F at a constantly varying rate during a 3-hour heating-up period.
3. During the heating-up period, heat was applied, at a gradually increasing rate, to the air within the building and transferred from the air to the walls, floor, ceiling, and furniture, except that portion which was necessary to raise the temperature of the air and to heat the air which filtered into the building by natural ventilation.
4. As the temperature of the air within the building was increased from 32 F to 70 F, the increase took place at a constantly varying rate, as shown by the dashed line of Fig. 4.
5. The exterior wall was of brick, 21 in. in thickness; its inner surface temperature was 35 F and its outer surface temperature, 1 F; so that, at the beginning of the heating-up period, the exterior wall was still losing heat to the air within the building and also to the air without the building.
6. The temperature gradient of the exterior wall was as shown by the heavy, broken line of Fig. 4.
7. The windows were glazed with single glass; their area was 815 sq ft.
8. The floor was 7.2 in. concrete slab; its area was 3600 sq ft. One-fourth of the concrete slab was over a basement in which the air temperature was 40 F throughout the heating-up period; the remaining three-fourths of the concrete slab rested directly on the ground, the temperature of which was 60 F throughout the heating-up period.
9. The ceiling was of wood, ¾ in. thick; its area was 43,000 sq ft.
10. The roof was of tin, on wood sheathing; its area was 43,000 sq ft.
11. The exterior wall was of brick; its inner surface area was 5300 sq ft.
12. The two outer doors were of wood, 2 in. thick; their area was 140 sq ft.
13. The interior columns and balconies were of wood; their weight was 18,000 lb.
14. The furniture was of wood; its weight was 9000 lb.
15. The volume of air within the building was 102,000 cu ft; its weight was 7600 lb.

SUMMARY—The author presents a study of the heat requirements of an intermittently heated building during the heating-up period. The maximum rate of heat flow is shown to be 543,000 Btu per hour for intermittent heating in contrast to a maximum flow of 314,000 Btu per hour for continuous operation.

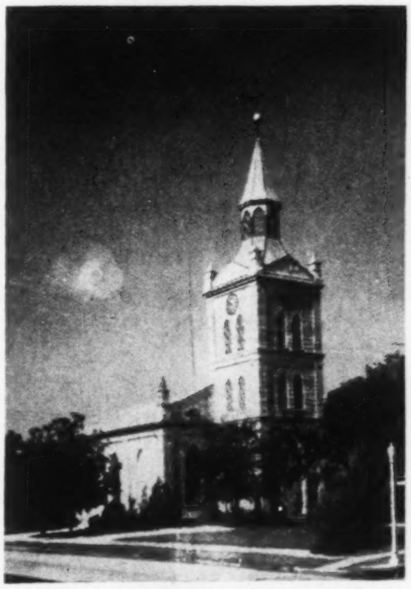


Fig. 1—A small and simple church

The study was based on the following reasoning:

1. As heat is applied to the air within the building, a portion of the heat is transmitted from the air to (*a*) the glass windows, (*b*) the wooden doors, (*c*) the wooden furniture, (*d*) the wooden columns and balconies, (*e*) the wooden ceiling, (*f*) the cement floor, and (*g*) the exterior brick wall.
2. The heat which is not so transferred is used to heat the air that filters into the building and to elevate the temperature of the air within the building.
3. The portion of the heat which is transferred to the furniture, columns, and balconies is consumed in elevating their temperatures.
4. The heat which is transferred to the windows, doors, floor, and ceiling is consumed partly in elevating their temperatures; the remainder passes to the outside of the building.
5. The portion of the heat which is transferred to the exterior masonry wall is absorbed by the wall and serves to elevate its temperature because a longer period of time than 3 hours is required for heat to flow through a 21-in. brick wall with the temperature differences assumed in this study.
6. It is sufficiently accurate, for the purpose of this study, to determine the flow of heat from air into a masonry wall, or other body, by means of the graphical method described in a recent paper.[1]

The Quantity of Heat Absorbed by the Wall

To study a variable flow of heat within a body, by the graphical method, it is necessary to divide the time into a series of equal intervals and to assume that the flow of heat remains constant during each interval. For this study, a 3-hour heating-up period was selected, and the time was divided into 9 intervals of 20 min each.

---

*Professor Emeritus, Agricultural and Mechanical College of Texas. Member of ASHVE.

For presentation at the 50th Annual Meeting of the American Society of Heating and Ventilating Engineers, New York, N. Y., January 1944.

[1] The Flow of Heat Through Walls, by F. E. Giesecke. (ASHVE Transactions, Vol. 45, 1939, p. 441.)

The modified differential equation for the flow of heat in a body is

$$\triangle_t\theta = \frac{k}{cw}\,\frac{\triangle t}{(\triangle x)^2}\,\triangle^2_x\theta \ldots. (1)$$

where

θ = varying temperature in degrees Fahrenheit.
$\triangle t$ = increment in time, in hours.
$\triangle x$ = increment in distance, in feet.
c = specific heat of the material.
w = weight of the material, in pounds per cubic foot.
k = thermal conductivity of the material, in Btu per hour per degree Fahrenheit, per foot.
t = time, in hours.
x = distance, perpendicular to the face of the wall, in feet.

To pass, by graphical methods, from one thermal gradient of the body to the next succeeding gradient, it is necessary to reduce Equation (1) to

$$\triangle_t\theta = \frac{1}{2}\triangle^2_x\theta \ \ldots\ldots\ldots\ldots (2)$$

This may be done by making

$$\triangle t = \frac{c\,w}{2\,k}(\triangle x)^2 \ \ldots\ldots\ldots\ldots (3)$$

Having assumed $\triangle t$ equal to 20 min or ⅓ hour, and assuming for the exterior brick wall, $k = 0.5$; $c = 0.2$; and $w = 125$, and substituting these values in Equation (3), $\triangle x$ is found to be 0.115 ft or 1.4 in.

Since this study is concerned only with the flow of heat from the air into the masonry wall during 9 periods of 20 min each, it is sufficient to set off 9 distances of 1.4 in. each, beginning at the inner surface of the wall, as shown in Fig. 4.

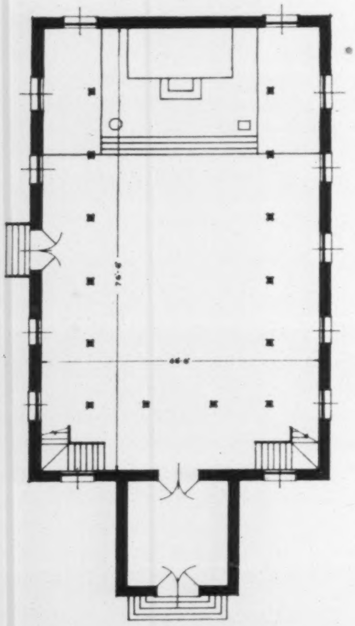


Fig. 2—Floor plan of church

The purpose of this study is to determine the rate at which heat flows from the air into the wall during each of the 9 successive 20-min periods. The quantity of heat which flows from the wall into the outdoor air, during the same periods, is irrelevant and, for that reason, it is not necessary to extend the successive thermal gradients farther than shown in Fig. 4.

The graphs of Fig. 4 were constructed as follows: The curved, dashed line represents the average air temperature, as the air is being gradually heated from 32 F to 70 F during the 3-hour period. The form of this curve was assumed so as to represent a gradual decrease in the rate of increase of air temperature; a slight change in the form of this curve would have no appreciable effect on the final outcome of the study.

The initial wall temperature gradient from 35 F on the interior surface to 1 F on the exterior surface was also assumed. The tangent to this gradient, at the inner wall surface, intersects the 32 F air temperature line at a point 3.64 in. from the wall surface. The slope of this tangent is (35-32)/3.64 or 0.824 deg per inch; multiplying this slope, *i.e.*, this thermal gradient at the inner wall surface by the thermal conductivity of the material, 0.5, for a gradient of 1 deg per foot, or 6, for a gradient of 1 deg per inch, determines the rate of heat flow from the wall to the air as 6 × 0.824 or 4.94 Btu per hour per square foot. The rate of heat flow may also be found by multiplying the temperature difference, wall surface to air, 35-32, by the film coefficient 1.65, namely, 3 × 1.65 or 4.95 Btu per hour per square foot.

The location of the tangent to the temperature gradient at the wall surface and its use in calculating the rate of heat flow from the wall into the air, or from the air into the wall, may be explained as follows:

Referring to the sketch in Fig. 4, the quantity of heat flowing from the air into the wall is equal to the temperature difference, air to wall surface, multiplied by the film coefficient, or to $a(t_a - t_s)$; it is also equal to the quantity of heat flowing, during the same period of time, from the surface of the wall into the layer of the wall adjacent to the surface; this is equal to the thermal gradient at the surface multiplied by the thermal conductivity of the material or to $k\,dy/dx$; hence, $a(t_a - t_s) = k\,dy/dx$. From the similar triangles, OFE and $dx\,dy$, it is evident that
$OF : FE :: dx : dy$; hence
$OF = FE\,dx/dy = (t_a - t_s)\,dx/dy = k/a$

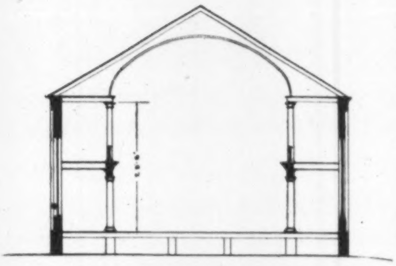


Fig. 3—Section of church

In the present study, relating to a brick wall, the values of k and a are, respectively, 6 and 1.65, and OF is, therefore, 3.64 in. The point O, where the tangent to the thermal gradient intersects the air temperature line, is the *directing point*. Having drawn the tangent, the rate of heat flow into the wall is found by multiplying the slope of the tangent (in degrees per foot or per inch) by the corresponding thermal conductivity. For example, the slope of tangent 4 is 4.66 deg per inch; the rate of heat flow into the wall is therefore 4.66 × 6 or 27.96 Btu per hour per square foot. This heat flow may also be calculated by multiplying the corresponding temperature difference, air to wall, 60.2-43.4, by the film coefficient 1.65, which gives 27.92 Btu per hour per square foot. Any difference in the values calculated by these two methods is the result of inaccuracies in the drawing or in the reading of the chart of Fig. 4.

The slopes of the 9 tangents shown in Fig. 4 are, respectively, 0.55 - 2.85 - 4.10-4.66-4.97-5.21-5.30-5.27 and 5.20 deg per inch.

The corresponding rates of heat flow, in Btu per hour per square foot, are 3.30-17.10-24.60-27.96-29.82-31.26-31.80-31.62 and 31.20.

The corresponding rates of heat flow, in Btu per hour for the entire wall, or for 5,300 sq ft, are 17,500-90,600 - 130,000 - 149,000 - 158,000-165,700-168,500-167,600 and 165,400. These values are shown in the chart of Fig. 7, in conjunction with the other rates of heat flow determined below.

The Rate of Heat Flow Through Windows and Doors

The thermal capacities of the windows and doors are so small that the increase in the quantities of heat stored in them during the heating-up period may be neglected in this study and the flow of heat calculated in the usual way.

The calculation may be simplified by combining the door areas with the window areas as follows: assuming *U*-values of 0.46 for the wooden doors and 1.13 for the single glazed windows, 46 sq ft of window surface will have the same heat loss as 113 sq ft of door surface; the 140 sq ft of door surface may therefore be replaced by 57 sq ft of window surface; this, when added to the 815 sq ft of window surface, gives an equivalent glass area of 872 sq ft.

The mean air temperatures during the nine 20-min periods, into which the heating-up time was divided, as shown by the curved line on Fig. 4, are 37.9-48.6-55.7-60.2-63.4-65.9-67.5-68.7 and 69.6 while the outdoor air temperature remains at zero.

The corresponding rates of heat flow through the doors and windows in Btu per hour are, therefore, 33,000-42,300-48,500-52,500-55,200-57,400-58,800-59,800 and 60,600. These values are shown in the chart of Fig. 7.

The Rate of Heat Flow Through the Ceiling

The ceiling and the roof sheathing are of thin wood; their thermal capacities are so small that it was considered sufficiently accurate to calculate the heat flow through them in the usual manner, using an over-all coefficient of 0.22. On this basis, the rates of heat-flow, in Btu per hour, during the nine successive 20-min periods are 37,000, 47,500, 54,400, 58,800, 61,800, 64,400, 66,000, 67,000 and 68,000. These values are shown in the chart of Fig. 7.

The Rate of Heat Flow Into the Concrete Floor Slab

One-fourth of the floor slab was assumed to be over a basement and the remainder to rest directly on the ground. The two sections were studied separately. For the section over the basement it was assumed that the air in the basement was 40 F at the beginning of the heating-up period and that it remained constant during that period; also, that the flow of heat through the slab had become constant and that the temperature gradient in the slab, at the beginning of the heating-up period, was a straight line. Under these conditions, the temperature of the lower surface of the slab was 37.3 F at the beginning of the heating-up period and the temperature of the upper surface was 34.7 F. Consequently, heat was still flowing from the basement through the concrete slab into the auditorium.

The flow of heat through the slab, during the nine 20 min periods, was studied by means of a chart like that shown in Fig. 4, and it was found that the nine successive, upper surface temperatures were 35.2, 36.0, 39.0, 40.9, 42.5, 44.0, 45.3, 46.5, and 47.6 F. By subtracting these temperatures from the corresponding air temperatures and multiplying the differences by 1.56—the film coefficient—it was found that heat was flowing into the slab at the rates of 4.2, 19.7, 26.1, 30.2, 32.6, 34.2, 34.7, 34.7, and 34.4 Btu per hour.

By multiplying these rates by the area of the slab, 900 sq ft, it

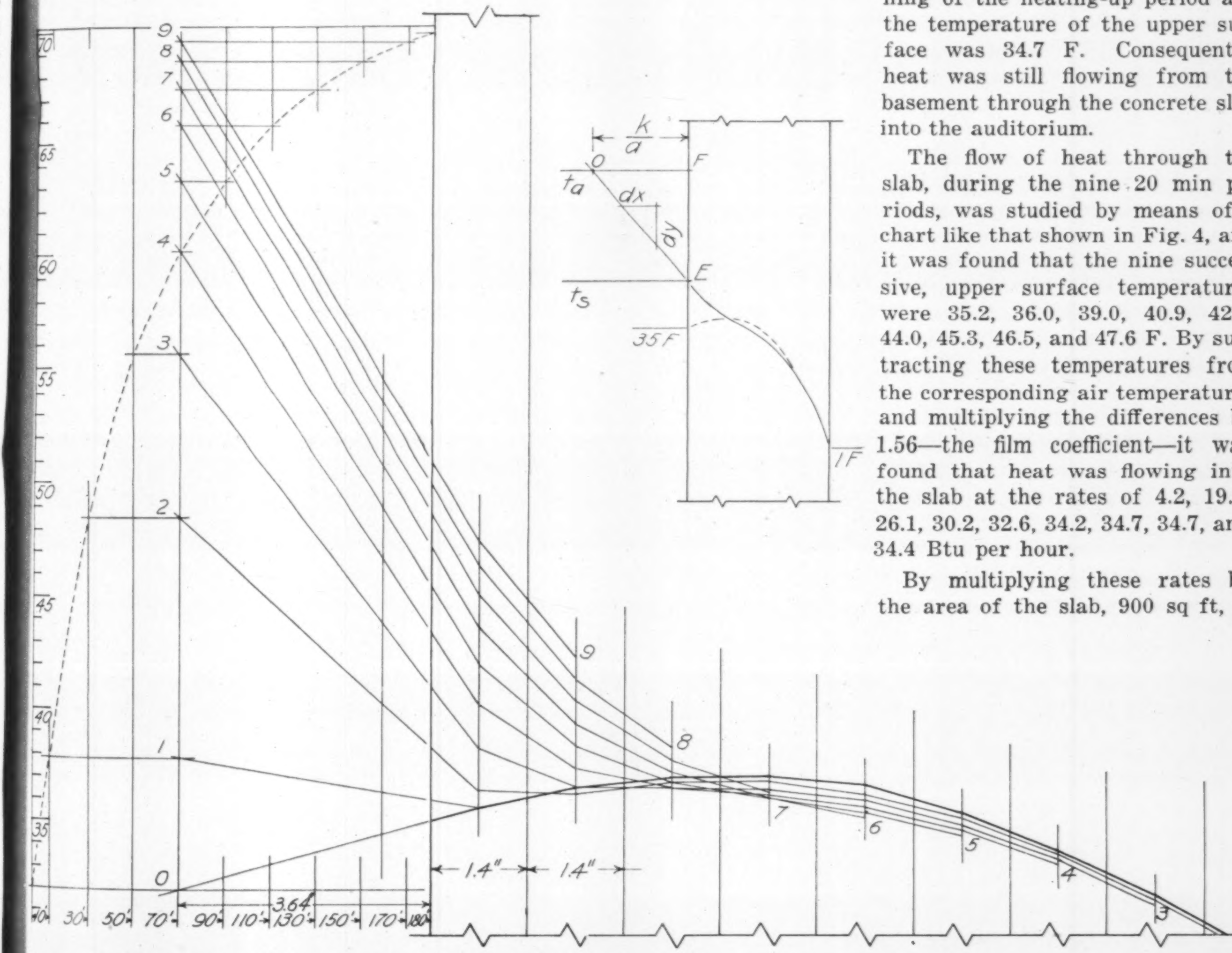


Fig. 4—A graphical study of the flow of heat into a cold 21-in. brick wall during a continuous rise in the temperature of the ambient air

was found that heat was flowing from the auditorium into the concrete slab above the basement at the rates of 3,800, 17,700, 23,500, 27,200, 29,300, 30,800, 31,200, 31,200, and 31,000 Btu per hour; these values are shown in the chart of **Fig. 7.**

For the section of the floor slab resting directly on the ground, it was assumed that the temperature of the ground was 60 F and remained constant during the heating-up period; also, that the flow of heat had become constant and that the temperature gradient in the slab was a straight line at the beginning of the heating-up period. The flow of heat through the slab was studied as described above and it was found that the nine successive, upper surface temperatures were 37.9, 41.7, 44.8, 47.4, 49.6, 51.6, 53.4, 54.9, and 56.3 F, and the rates of heat flow into the slab were 0.0, 14.1, 17.0, 20.0, 21.6, 22.3, 21.9, 21.6, and 20.8 Btu per hour per square foot, and that heat was flowing from the auditorium into the concrete slab resting directly on the ground at the rates of 0, 38,100, 46,000, 54,000, 58,400, 60,200, 59,100, 58,400 and 56,200 Btu per hour. These values are shown in the chart of Fig. 7.

The Rate of Heat Flow Into the Wooden Furniture, Columns, and Balconies

Assuming the weight of wood as 45 lb per cubic foot, the thermal conductivity as 0.12 Btu per hour per degree Fahrenheit per foot, and the specific heat as 0.5, the distance interval $\triangle x$ must be 0.695 in. if the time interval $\triangle t$ is to be 20 min. Evidently, a distance interval of 0.695 in. is too large for use in studying heat flow in thin wooden members like those used in the construction of furniture, floors, etc. For those cases the distance interval should not exceed $\frac{1}{8}$ in. and, consequently, the time interval should not exceed 6.4 min; using these values to study heat flow during a 3-hour period would necessitate drawing about 55 thermal gradients instead of the nine shown in Fig. 4; this would be very difficult and it appears practically impossible to study the flow of heat in thin wooden members by the usual graphical method. For that reason an approximate method was adopted which is based on the following reasoning.

If a large wooden slab were cooled to 32 F and placed in the auditorium at the beginning of the heating-up period, it would absorb heat from the surrounding air and its surface temperatures would increase as the temperature of the surrounding air increases, but its increase in surface temperature would lag behind that of the air temperature.

If the thickness of the slab were reduced, the lag in the increase of surface temperature would also decrease and as the thickness of the slab approaches zero the lag would also approach zero. A sheet of wood so thin that its thermal capacity is negligible would always be at the temperature of the surrounding air.

This is illustrated in Fig. 5. The temperatures shown there on the Line *AB* are the mean air temperatures of the nine successive 20-min periods derived from Fig. 4. The temperatures on the Line *CD* are the corresponding surface temperatures of a slab of wood 6.26 in. thick, determined as shown in Fig. 6. The temperatures on Line *EF* are the corresponding surface temperatures of a slab of wood 4.17 in. thick, determined in a manner similar to that shown in Fig. 6.

The differences between the temperatures shown on Line *CD* and those shown on Line *EF* are smaller than was expected; both were determined as accurately as possible.

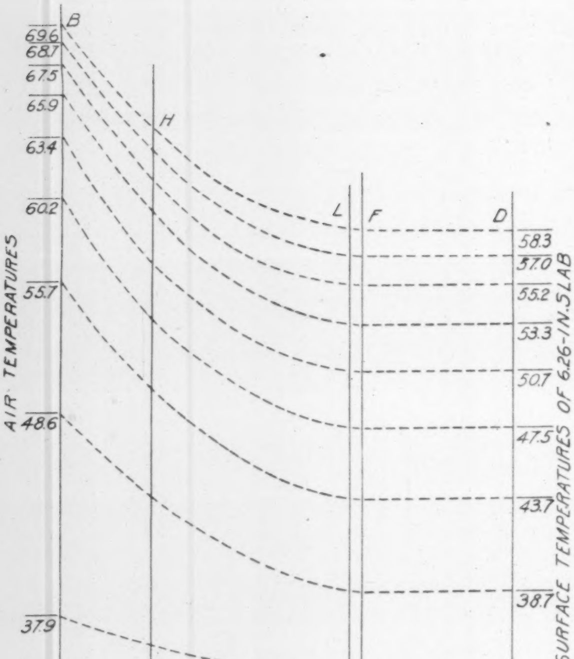


Fig. 5—An approximate method of determining the surface temperatures of thin slabs or of thin walls

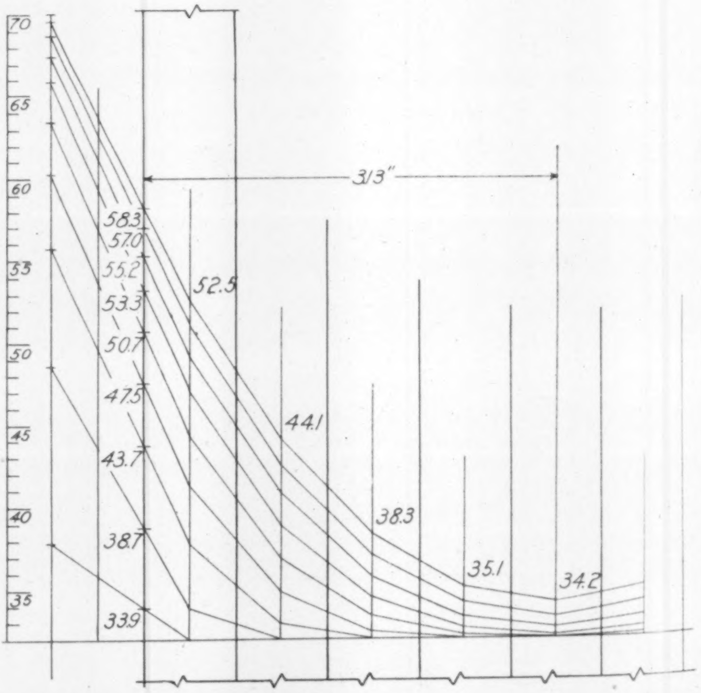


Fig. 6—A graphical study of the varying surface temperature of a 6.26-in. wooden slab during a continuous rise of the temperature of the ambient air

The dashed lines are intended to show the probable variation in the nine mean surface temperatures as the thickness of the wooden slab is reduced from 6.26 in. to zero.

If it is assumed that the principal parts of the furniture are built of 1¼ in. boards, the successive surface temperatures might be determined by drawing a line *GH* parallel to and at a distance of 1¼ in. from line *AB* in Fig. 5.

In this manner the successive temperature differences, air to surface of wood, were found to be 1.7, 4.8, 6.0, 6.7, 6.9, 6.7, 6.5, 6.3, and 5.9 deg. The weight of the furniture was estimated to be 9000 lb.

The furniture was, therefore, replaced by 1920 sq ft of 1¼ in. boards; and the heat absorbed by these boards found by multiplying 1920 by 2 × 1.65, since heat flows into the boards from two sides, and by the successive temperature differences listed, to be 10,800, 31,000, 38,000, 42,500, 43,800, 42,500, 41,200, 40,000 and 37,400 Btu per hour. These values are shown in Fig. 7.

The heat flow into the columns and balconies was found by assuming that it would be equal to the heat flow into a 4 in. wooden slab of equal weight, 18,000 lb, *i.e.*, into a 4 in. slab having a surface area of 1200 sq ft on each side. The line *KL* in Fig. 5 was drawn parallel to and 4 in. from line *AB* and the temperature differences, air to wood surface, found to be 4.0, 9.7, 12.0, 12.6, 12.7, 12.7, 12.2, 11.7, and 11.1 deg. By multiplying these temperature differences by 2 × 1.65 × 1200 the following rates of heat flow were found: 15,800, 38,400, 47,400, 49,900, 50,300, 50,300, 48,400, 46,400, and 44,000 Btu per hour. These values are shown in Fig. 7.

The following interesting information may be obtained from the chart of Fig. 6:

1. The air temperature rose from 32 F to 69.6 F during the heating-up period.

2. The surface temperature of the wooden slab rose from 32 F to 58.3 F.

3. The temperature of the wood in the center of the slab rose from 32 F to 34.2 F.

4. The average rise of the temperature of the wooden slab was about 9.6 deg.

5. The quantity of heat absorbed by the wooden slab was about 9.6 × 3.75 × 3.13 × 0.5 or about 56 Btu per square foot of exposed surface, during the heating-up period, or about 18.7 Btu per hour.

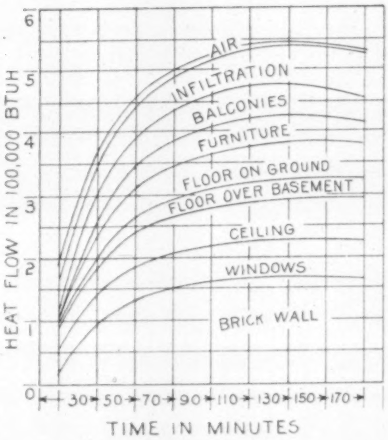


Fig. 7—The summation of the nine rates of heat flow, or heat loss, during the three-hour heating-up period, divided into nine 20-minute intervals

6. The average temperature difference, air to slab surface, was, therefore, about 18.7/1.65 or about 11.3 deg.

7. The temperature differences, air to slab surface, shown in the chart of Fig. 6, range from about 4 deg to about 11.3 deg; their average value is about 9.9 deg, which checks fairly well with the calculated value based on the quantity of heat absorbed, as determined by the graphical method.

Rate of Loss of Heat Resulting from Infiltration

It was assumed that air filtered into the auditorium at the rate of 50,000 cfm, about one-half the volume of the auditorium; also that the average weight of the air was 75 lb per 1000 cu ft and that its specific heat was 0.25. On this basis, the resulting rates of heat loss for the nine consecutive 20-min periods were: 35,500, 45,500, 52,100, 56,400, 59,300, 61,600, 63,100, 64,400, and 65,100 Btu per hour. These values are shown in the chart of Fig. 7.

Table 1—Heat Loss Calculation

SURFACE	AREA	COEFFICIENT	TEMP. DIF.	HEAT LOSS BTU PER HOUR
Walls	5300	0.20	70	74,200
Glass	815	1.13	70	64,500
Doors	140	0.46	70	4,500
Ceiling	4440	0.22	70	68,500
Floor	900	0.53	30	14,300
Floor	2700	0.83	10	22,400
Infiltration,	50,000	cu ft....	70	65,600
				314,000

Rate of Heat Absorption by the Air Within the Auditorium

Assuming the volume of air within the auditorium as 102,000 cu ft, its weight as 7,600 lb, and its specific heat as 0.25, the nine successive rates of heat absorption, based on the rates of temperature rises listed above, are 61,500, 49,000, 41,600, 21,100, 14,800, 11,400, 7,400, 5,700, and 4,000 Btu per hour. These values are shown in the chart of Fig. 7.

Maximum Rate of Heat Flow

According to this study, the maximum rate of heat flow was about 543,000 Btu per hour. According to the usual method of calculating heat losses, the maximum rate of heat flow would be about 314,000 Btu per hour, as shown by the following calculation. Consequently, the capacity of the heating plant should be about 543,000/314,000 or about 1.73 times as large for the intermittently heated church as for the same building heated continuously, under the conditions assumed for this study (see Table 1).

Conclusions

1. A building heated intermittently requires a heating system of considerably larger capacity than the same building heated continuously.

2. The subject of intermittent heating is of sufficient importance to justify additional studies to determine the effects of outdoor temperature, interval between heating periods, length of heating-up period, and the form, size, and type of building.

Acknowledgment

The author is indebted to E. K. Campbell, President, E. K. Campbell Heating Co., Kansas City, Mo., for much valuable aid in the preparation of this paper and particularly for the choice of the determination of the highest rate of heat in-put during the heating-up period, rather than the total quantity of heat in-put during that period, as the prime object of the study, and to Dr. H. Grober, Director, Charlottenburg Experiment Station for Heating and Ventilating, for the selection of an assumed variable indoor air temperature as the basis for the study of intermittent heating.

Nominees for Committee on Research

(Three-Year Term)

C. M. Ashley, Syracuse, N. Y. (complete biographical sketch published in ASHVE Journal Section, November 1943, p. 615).

⁂

Dr. Frederick E. Giesecke, College Station, Tex., now doing special research work at the University of Illinois Experiment Station, was born in Washington County, Texas, on January 28, 1869. He received his preparatory education in the New Braunfels and San Antonio Schools, and began his professional career at the A. and M. College of Texas, College Station, Tex., from which he received his M.E. in 1890. In 1904 he received a degree of S.B. from the Massachusetts Institute of Technology, and from 1886 to 1912 he was a teacher at the Texas A. and M. College. In 1906-07 he studied European heating and ventilating methods in Germany. As college architect he designed and directed installations of heating systems in new buildings from 1908 to 1912.

In 1913 he became professor of Architecture at the University of Texas, Austin, as well as consulting architect, specializing in heating and ventilating. He received a doctor's degree from the University of Illinois.

Dr. Giesecke assumed the duties of Director of the Engineering Experiment Station at A. and M. College on September 1, 1927. He has been a member of the ASHVE since 1913, and has wide experience as engineer and educator, being distinguished for his researches in the fields of hot water heating, heat transmission and air conditioning for comfort. He is also considered an authority on radiant heating methods.

His retirement as Director of the Engineering Experiment Station occurred on September 1, 1939, and he is now Professor Emeritus in heating, ventilating and air conditioning at the College.

Dr. Giesecke is a past president of the Society, having served in 1940, as First Vice-President in 1939 and Second Vice-President in 1938, and he has served on the Society's Council since 1932. He has served as chairman of the Executive Committee and on many important Research Technical Advisory Committees of the Society during the past few years.

In January 1942 he received the F. Paul Anderson Gold Medal awarded by the Society for distinguished scientific achievement. The Committee on Award honored Dr. Giesecke for his notable contributions to the advancement of heating based on his research work in the fields of heat transfer and hot water heating, and for his eminent services to the Society as a member and officer.

He is the author of several technical books, including *The Design of Gravity-Circulation Water Heating Systems*, published in 1926, and the joint author with A. Mitchell and H. G. Spencer of, *Technical Drawing*, and *Technical Drawing Problems*, and other technical books and papers.

⁂

F. C. McIntosh was born at Olean, N. Y., on September 4, 1890. He attended the University of Wisconsin, where he received his B.S. degree in Civil Engineering in June 1913.

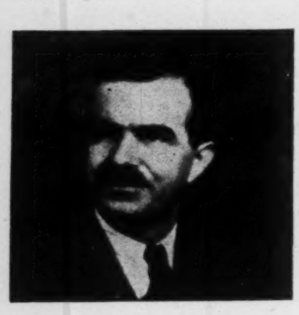
In 1917 he became affiliated with the Johnson Service Co., acting as representative of their office in Omaha, Neb., until he enlisted, in July of that year, as a private in the Army.

In September 1919 he was discharged from military service as First Lieutenant and returned to the Johnson Service Co. as manager of their Pittsburgh office, which position he now holds.

Mr. McIntosh joined the ASHVE in 1917, and has served in many capacities. He was a member of the Society's Council for over six years, served as chairman of the Committee to Draft Rules of Award for F. Paul Anderson Medal, and as chairman of the Finance Committee for two years. He also served as chairman of many Society committees, such as Membership, Guide Publication, Publication, Constitution and By-Laws for two years, and Nominating.

Mr. McIntosh was chairman of the Committee on Research in 1942, and served as chairman of its Executive Committee during that year. He is at present serving on the Committee on Research and its Executive Committee, and on the Research Technical Advisory Committee on Sensations of Comfort. Since his association with the Society he has served on numerous Research Technical Advisory Committees.

Besides being a member of the Society he holds membership in the Engineering Society of Western Pennsylvania.


C. M. Ashley
Syracuse, N. Y.

F. E. Giesecke
College Station, Texas

F. C. McIntosh
Pittsburgh Pa.

G. L. Tuve
Cleveland, Ohio

G. L. Tuve, a member of the ASHVE for over ten years, was born at Canton, S. D., on May 26, 1896, where he attended public schools, Augustana Academy, and Augustana College, Sioux Falls. He attended Northwestern University, Evanston, Ill., then the University of Minnesota, Minneapolis, Minn., receiving degrees of B.S. and M.E. from the latter.

After a year as experimental engineer with Mahr Mfg. Co., Minneapolis, he became Instructor, and later Assistant Professor of mechanical engineering, University of Minnesota. He also served as Assistant Professor of mechanical engineering at the University of Montana, Bozeman, Mont., as Professor and Head of department of mechanical engineering at the Texas Technological College, Lubbock, Tex., and as Test Engineer for the Public Service Co. of Northern Illinois, Chicago. From 1930 to date he has been associated with Case School of Applied Science, Cleveland, Ohio, as professor of mechanical engineering in charge of Heat-Power Division, and M. E. Laboratory.

Professor Tuve specialized in heating, ventilating, air conditioning, heat transmission and air flow, and has acted as consultant on research and development work for many firms in the industry.

He is co-author with Prof. C. F. Shoop of a text book on *Mechanical Engineering Laboratory Practice*, which includes instructions for the common test work encountered by heating and ventilating engineers.

Professor Tuve is also a member of the *American Society of Mechanical Engineers*. Since he joined the ASHVE in 1932 he has served on many of the Research Technical Advisory Committees, such as Direct and Indirect Radiation with Gravity Air Circulation, Heat Transfer of Finned Tubes with Forced Air Circulation, Air Distribution and Air Friction, Intermittent Heating, Instruments, and Insulation. He has served as a member of the Society's Council from 1939-1941, and as a member of its Meetings and Standards Committees. He also served as a member of the Guide Publication Committee, and as a member of the Committee on Research for three-year term beginning in 1937.

In his affiliation with the Cleveland Chapter of the Society he served on the Board of Governors for a number of years and as its president in 1936.

Professor Tuve has presented numerous papers before Society meetings, all of which appear in the Transactions.

⁂

Thomas H. Urdahl, now Commander in USNR, was born July 8, 1901 at Colorado Springs, Colo., received his elementary and high school education in Madison, Wis., and Philadelphia, Pa., and later studied mechanical engineering at Swarthmore College, Swarthmore, Pa., and in addition studied physics, economics and business law.

In 1922 he entered the employ of Col. P. M. Anderson, architect, Washington, D. C., and was given the responsibility of design, supervision, coordination of construction projects. In 1926 began his private practice as consultant and designer for mechanical and electrical systems in power, heating, ventilating, and air conditioning. In 1927 he was associated with A. M. Daniels, consulting engineer and technical author, Washington, D. C. In this connection he prepared heating and ventilating plans and specifications for and supervised the installation of heating and ventilating equipment, undertaking fuel conservation and combustion analyses, compiling data and writing reports.

He joined the ASHVE in 1930, and since then has served on many Society committees. He served on the Council of the Society, as a member of the Meetings Committee, the Joint Committee on Standards for Residence Heating, the Committee on Research and on its Executive Committee, as chairman of the Committee on Admissions and Advancement, and the Technical Advisory Committee on Weather Design Conditions, and as a member of the Technical Advisory Committee on Fuels.

Commander Urdahl was president of the Washington, D. C., Chapter of the Society in 1939, vice-president from 1934-36, and served as a member of the Board of Governors for a number of years.

⁂

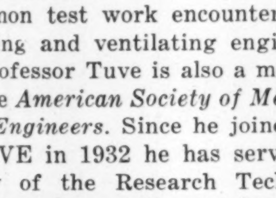
Two-Year Term

John James, Engineer, Iron Fireman Mfg. Co., Cleveland, Ohio, was born in Brookville, Ind., January 12, 1907. He received his early schooling in Portland, Ore., and received a B.S. in M.E. in 1928 from Oregon State College.

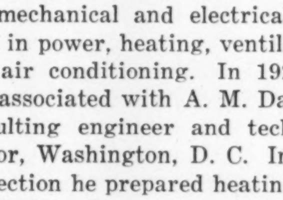
After graduation from Oregon State College, Mr. James entered a consulting office in Portland, Ore. Four years later he was awarded a research fellowship at the University of Wisconsin, where he received a master of science degree in 1934, and then entered the research field through General Electric Co., Schenectady, N. Y.

During his seven years' service with the American Society of Heating and Ventilating Engineers, Mr. James' responsibilities included the preparation of technical data for the annual Guide, the correlation and administration of the cooperative research program of the Society, and work with the technical and code committees. As Technical Secretary of the Society he presented several papers and was a frequent speaker at Chapter meetings.

He is the author of a number of technical articles and is a member of Sigma Xi, national honorary scientific society.



T. H. Urdahl
Washington, D. C.



John James
Cleveland, Ohio

SUMMARY OF LOCAL CHAPTER MEETINGS

Chapter	Meeting Date	Subject	Speakers	Other Features	Attendance	Attendance Ratio*
Cincinnati	Nov. 2	Activities of the Society in Wartime	Merrill F. Blankin, Pres., ASHVE	Report on Library Committee by O. W. Motz	23	0.39
	Oct. 12	Some Engineering Aspects of the "Big Inch" Pipelines	Lewis F. Scherer, Supt., Station Construction for War Emergency Pipelines, Inc.	Announced appointments to several committees Committee chairmen submitted reports	32	0.49
Delta	Oct. 5	Reheating and Air Conditioning Contrcl	C. B. Gamble	Action of Fuel Conservation Committee Ballot—Future type of meetings Light Entertainment	26	0.72
Indiana	Nov. 1	Future of Air Conditioning	Dr. B. M. Woods, Dir., University Extension, University of California	Comdr. T. H. Urdahl, Bureau of Ships, Washington, D. C., spoke briefly on heating and ventilating problems in shipbuilding program	90	1.87
		Present Fuel Situation	John Howatt, Chicago, Ill., Chairman, War Service Committee	Pres. Blankin introduced the Council members, Messrs. Campbell, Collins, Downs, Howatt, McDonnell, Saunders, Russell, Dr. Woods, Comdr. Urdahl, Prof. L. G. Miller, and also Cyril Tasker		
		Informal Address (Purchase of War Bonds)	Merrill F. Blankin, President of Society			
Iowa	Oct. 12	Fuel Conservation Program		B. E. Landes reviewed methods of saving fuel outside of the boiler room	12	0.48
		Why It Is Necessary to Conserve Fuel	Pres. C. W. Helstrom			
		Why Fuel Saving Is Good Business	C. A. Wheeler			
		The Importance of "Three T's" (temperature, time and turbulence)	F. E. Triggs			
Kansas City	Oct. 25	Fuel Conservation	T. C. Cheasley, Supervising Engr., National Fuel Efficiency Section, Bureau of Mines, Washington, D. C.	Treasurer and chairman of Membership Committee submitted reports. E. K. Campbell reported on subject of Chapter-Society relationship.	48	0.62
Massachusetts	Oct. 19	Low Temperature and Low Barometer Air Conditioning in Test Rooms	L. R. St. Onge, Philadelphia Branch, Chief Engr., York Corp.		80	1.06
Michigan	Oct. 11	The Art of Air Recovery	Henry Sleik	Lieut. Morris, U.S.N., spoke on need for officers for various branches of Navy Two colored motion picture films entitled, "A New World Through Chemistry" and "India"	53	0.38
Montreal	Oct. 18	The Treatment of Boiler Feed Water	W. J. Thomlinson		36	0.60

CHAPTER	MEETING DATE	SUBJECT	SPEAKERS	OTHER FEATURES	ATTENDANCE	ATTENDANCE RATIO*
Nebraska	Oct. 19	Geological Formation of Coal and Its Mining for Present Day Requirements	C. E. Wilson, Pittsburgh and Midway Coal Mining Co.	Nominating Committee announced: Verne Simmonds, B. K. Eaton and Henry Kleinkauf	15	0.60
		Uses of Natural Gas	John S. Adams, Northern Natural Gas Co.			
North Carolina	Oct. 22	Accurate Short Cuts and Designs of Ship Ventilation	Comdr. T. H. Urdahl, Bureau of Ships, Washington, D. C.	Combined meeting with ASME group	35	0.28
		The Necessity of Fuel Conservation	Pres. F. J. Reed			
Northern Ohio	Oct. 11	Three U. S. Navy Sound Films — Navy Ashore, Save Those Tools, Ships of the U. S. Navy.	Lt. J. U. Sheridan, USNR, Bureau of Ships	Plans announced for day train trip to New York for Annual Meeting	34	0.50
Ontario	Nov. 4	What Physical Environment Means to Man	Dr. Clarence A. Mills, University of Cincinnati		86	0.80
	Sept. 27	Coal Conservation	N. W. Kingsland, Director of Coal Conservation, Office of Coal Controller	Presentation made to Cyril Tasker, new Director of Research of Society		
		Fuel Oil	A. Morgan, Oil Controller's Office, Dept. of Munitions and Supply			
Pacific Northwest	Oct. 6	Fuel Oil Rationing	L. V. Halverson, Repr. Fuel Div., Seattle Office OPA	Personnel of Program and Membership Committees announced	21	0.57
Philadelphia	Oct. 14	Fuel Conservation Forum	C. G. Pierie, WPB; S. T. McKenzie, Babcock & Wilcox; L. D. Betz, W. H. & L. D. Betz Co.; A. T. Luken, Philadelphia Steam Co.; R. M. Minguez, Philip Carey Co.; Allen Johnson, Anthracite Industries; E. L. Wilson, Solid Fuel Adm. of Philadelphia Area	Merrill F. Blankin, President of ASHVE, gave short address	92	0.77
Southern California	Oct. 13	Importance of Fuel Conservation in Southern California Area	F. M. Foster, Mgr. Commercial and Industrial Gas, Southern California Gas Co.	Art Theobald gave the Treasurer's report, and announced purchase of a $100 War Bond from Chapter's funds	69	0.76
		Temperature Controlled Equipment	J. R. Campbell, Designing Engr., General Electric Co.			

---

*The attendance ratios shown represent the meeting attendance divided by the Chapter membership. These will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by other local chapters and may be helpful in deciding on subjects for other chapter meetings.

HERMAN F. MAIER DEAD

Notification has recently been received of the death in 1942 of Herman F. Maier, chief engineer and secretary of the New York Blower Co., Chicago, Ill. His sudden death came as a great shock to his associates and friends.

Mr. Maier was born at Bucyrus, Ohio, September 7, 1894, and he started in the engineering field in 1912 as a draftsman. After several years in the industrial and architectural field he joined the New York Blower Co. in 1920 as chief draftsman and was responsible for the design of the ventilation systems for many schools and other public buildings in the Chicago area. He is survived by his widow, Edith F. Maier, and three sons, two of whom are in the service, Robert, a Corporal in the U. S. Army overseas, and George, B. M. 2/c, in the Coast Guard.

The Officers and Council have expressed their sincere sympathy to Mr. Maier's widow and family who survive.

DEATH OF ROBERT W. RODMAN

The Board of Education of the City of New York lost one of its career men in the death of Robert W. Rodman, Superintendent of Custodians, and the Society lost a newly elected Life Member. Mr. Rodman died October 31 at Lenox Hill Hospital after an illness of several weeks, following his retirement from the Board of Education after nearly 48 years of service.

He was born in 1874 at Wallington Hollow, Dutchess County, N. Y., and after graduation from High School he attended the College of the City of New York. In 1896 following his graduation from City College, he became a sanitary inspector in the Bureau of Buildings, Department of Education, after passing the competitive examinations.

In 1919 he was appointed Superintendent of Plant Operation and several years ago, when the Building and Maintenance Bureau was reorganized, his title was changed to Superintendent of Custodians. In 1942 Mr. Rodman celebrated the 46th anniversary of his entrance into the service of the New York City School System, and this occasion was recognized by his many friends at the Board of Education headquarters in Brooklyn.

At the time of Mr. Rodman's death Dr. John E. Wade, Superintendent of Schools of the City of New York, paid this tribute to him. "The public schools have lost a valuable, intelligent and faithful servant. His work was done quietly and without ostentation. Those who were in a position to know how much he contributed to the physical maintenance of the school plant valued his service accordingly."

Mr. Rodman was a member of the American Society of Heating and Ventilating Engineers, American Society of Mechanical Engineers, the New York Athletic Club and the Winged Foot Country Club. He is survived by two brothers, Frank and Sheldon.

A requiem mass was said at the Blessed Sacrament Church, New York, and interment was made at Calvary Cemetery.

The Officers and Council regret the loss of a distinguished and loyal member of the Society.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the Journal of the Society or sent to the members in other approved manner as ordered by the Council. When replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 61 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by December 15, 1943, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

CANDIDATES	REFERENCES	
	Proposers	*Seconders*
Allen, J. Lloyd, Partner, Allen & Kelley, Architects, Indianapolis, Ind.	G. B. Supple C. H. Hagedon	S. E. Fenstermaker W. C. Bevington
Arzet, Fred A., Foreman & Me. (Dust Collection Maintenance), Allison Division—General Motors Corp., Indianapolis, Ind.	W. C. Bevington C. H. Hagedon	C. W. Stewart F. H. Gaylord
Baxter, H. A., Sales Mgr., W. H. Cunningham & Hill, Ltd., Toronto, Ont., Canada.	G. H. Hopper J. P. Fitzsimons	S. A. Jennings D. A. Long
Blackman, Robert C., Power Engr., Allison Division—General Motors Corp., Indianapolis, Ind.	G. B. Supple R. D. Tutt	W. C. Bevington S. E. Fenstermaker
Burbo, W. C., New England Branch Mgr., Ilg Electric Ventilating Co., Boston, Mass.	C. M. Peterson H. M. Tarr	H. C. Moore T. P. Mandell
Cannon, Capt. Vernon K., Q.M.C., United States Army, Ft. Francis E. Warren, Wyoming.	N. H. Brickham O. G. Ward	L. R. O'Rear J. J. Philippi
Carlson, Clarence J., Regional Mgr., Carlson Brothers Company, Detroit, Mich.	C. H. Hagedon W. T. Miller	S. E. Fenstermaker W. C. Bevington

CLEMENS, J. E., Engr. in Charge, Plant Engineering Dept., Plant No. 3, Allison Division—General Motors Corp., Indianapolis, Ind.	W. C. Bevington S. E. Fenstermaker	G. B. Supple R. D. Tutt
CLUCAS, EDWARD T., Dist. Mgr., Minneapolis-Honeywell Regulator Co., Indianapolis, Ind.	J. G. Hayes C. N. Warren	S. E. Fenstermaker G. O. Jackson
COLBY, JOHN R., Pres., Colby Equipment Co., Indianapolis, Ind.	E. J. Ritchie R. W. Cumming	W. C. Bevington S. E. Fenstermaker
CORRIGAN, JAMES A., Treas., Corrigan Co., St. Louis, Mo. *(Advancement)*	B. C. Simons C. F. Boester	W. J. Oonk E. H. Ronsick
DEHLER, FRANK C., Chemical Engr., The Davison Chemical Corp., Baltimore, Md.	J. deB. Shepard E. H. Taze	T. H. Urdahl *O. D. Calvin
DEVERALL, C. R., Asst. Executive, Purdue University, W. Lafayette, Ind.	C. F. Boester W. T. Miller	G. S. Meikle R. B. Marshall
DRUM, ROBERT I., Gen. Foreman, Air Conditioning, Allison Division—General Motors Corp., Indianapolis, Ind.	S. E. Fenstermaker W. C. Bevington	R. D. Tutt W. T. Miller
DWYER, WILLIAM H., Sales Mgr., Central Supply Co., Indianapolis, Ind.	G. B. Supple S. E. Fenstermaker	W. C. Bevington C. H. Hagedon
ESKRA, G. N., Sales Engr., Pacific Metals Co., Ltd., San Francisco, Calif.	Mason Emanuels J. A. Kooistra	R. A. Folsom R. B. Holland
FENSTERMAKER, WARD R., Air Conditioning Engr., Allison Division—General Motors Corp., Indianapolis, Ind.	C. H. Hagedon R. D. Tutt	S. E. Fenstermaker G. B. Supple
FOX, W. L., Engr., U. S. Machine Corp., Lebanon, Ind.	W. T. Miller C. F. Boester	G. L. Coryell O. D. Waldon
GALLOWAY, MAX W., Foreman, Allison Division—General Motors Corp., Indianapolis, Ind.	S. E. Fenstermaker C. H. Hagedon	W. C. Bevington C. W. Stewart
GARDNER, MARVIN R., Naval Arch., U. S. Maritime Commission, Chicago, Ill.	C. M. Burnam, Jr. A. O. May	J. H. Clarke C. E. Price
GATES, JAMES N., Htg., Vtg. and Air Cond. Engr., Air Conditioning Co., Cambridge, Mass.	R. A. Sheffield John Bonner	C. M. Peterson H. M. Tarr
GOLDNER, HERMAN W., Pres., Herman Goldner Co., Inc., Philadelphia, Pa.	M. F. Blankin H. C. Cody	C. F. Dietz H. H. Erickson
GOOHS, WM. E., Ass't to Plant Engr., Allison Division—General Motors Corp., Indianapolis, Ind.	G. B. Supple R. D. Tutt	W. C. Bevington S. E. Fenstermaker
GUZZARDI, SALVATORE S., Marine Engr., Otten, Liskey & Rhodes, Washington, D. C.	J. W. Markert F. A. Leser	J. H. Fogg H. R. Iverson
HALLENBECK, CHARLES W., Dist. Engr. for T. C. Heyward, representing Carrier Corp., Charlotte, N. C.	K. W. Selden, Jr. M. F. Wooten, Jr.	L. F. Kent G. B. Smoot
HAND, WILLIAM L., Consulting Engr., W. L. H. Engineering Service, Chicago, Ill.	I. E. Brooke J. J. Aeberly	A. O. May J. J. Hayes
HILMER, GEO. O., Mech. Designer & Engr., Robert & Co., Atlanta, Ga.	K. W. Selden, Jr. L. F. Lawrence, Jr.	A. H. Koch W. J. McKenney
HOFFMANN, WALTER A., Engr., L. S. Ayres & Co., Indianapolis 9, Ind.	G. B. Supple S. E. Fenstermaker	W. C. Bevington C. H. Hagedon
HOSMER, GEORGE H., Pres., The Hosmer Stoker Corp., Indianapolis, Ind.	J. H. Niesse W. C. Bevington	S. E. Fenstermaker C. H. Hagedon
KEIM, EUGENE C., Branch Mgr., U. S. Radiator & Pacific Steel Boiler Corp., Detroit, Mich.	C. W. Stewart S. E. Fenstermaker	W. C. Bevington E. N. Sanbern
KERBEL, JESSE, Designer-Draftsman, Chemical Construction Corp., New York, N. Y.	Nathan Feder E. H. Morgan, Jr.	*W. D. Burack *H. W. Hale
KITCHEN, DARLEY E., Owner, Kitchen Coal & Heating Co., Logan, Ohio.	R. A. Sherman F. T. W. Armbruster	C. F. Lorimor H. R. Allenier
LEE, CARL M., Supervisor Air Cond., Allison Division—General Motors Corp., Indianapolis, Ind.	S. E. Fenstermaker C. H. Hagedon	W. C. Bevington C. W. Stewart
LEWIS, GELDER V., Vice-Pres., John G. Lewis Plumbing & Heating Co., Kansas City, Mo.	J. G. Lewis W. A. Russell	DeWitt M. Allen M. M. Rivard
MALADY, EDWARD C., Engrg. & Estimating, Brak Snodgrass, Inc., Indianapolis, Ind.	S. E. Fenstermaker W. C. Bevington	R. D. Tutt C. W. Stewart
MARR, J. M., Ch. Engr., Aladdin Heating Corp., Oakland, Calif.	S. W. Terry H. V. Hickman	E. C. Cooley D. I. Murphy
MATTHEWS, R. R., Owner, Matthews Engineering Co., Dallas, Tex.	W. H. Moler L. S. Gilbert	J. A. Ray E. T. Gessell
MEANS, JAMES MACG., Mfgr's Agent, Boston, Mass.	P. A. L. Foulds E. L. Blair	H. M. Tarr T. P. Mandell
MULREY, MAURICE D., Owner, T. A. Mulrey & Son, Indianapolis, Ind.	G. A. Voorhees G. C. Joslin	R. D. Tutt S. E. Fenstermaker
NYLAND, J. A., Owner, Nyland Sheet Metal Co., Indianapolis, Ind.	G. C. Joslin C. H. Hagedon	W. T. Miller W. C. Bevington
ORABELLA, MICHAEL J., Pres., Ohio National Products, Inc., Cleveland, Ohio.	P. D. Gayman J. F. Platz	D. L. Taze L. T. Avery
OSBORNE, J. M., Engr. (Field), The Herman Nelson Corp., Moline, Ill.	E. J. Febrey W. H. Littleford	W. C. Jones Lester Maurer
PAYTON, JOHN F., Air Cond. Engr., Allison Division—General Motors Corp., Indianapolis, Ind.	S. E. Fenstermaker C. H. Hagedon	W. C. Bevington C. W. Stewart
PHERIGO, FAUN S., Heating Dept., Indianapolis Power & Light Co., Indianapolis, Ind.	S. E. Fenstermaker C. H. Hagedon	W. C. Bevington C. W. Stewart
PROCTOR, CHARLES W., Sales Engr., The Conditioning Co., Inc., Newark, N. J.	V. S. Day Robert Reis	E. T. Murphy W. D. Graham
RANDALL, GORDON E., Supt., Randall & Co. Ltd., Winnipeg, Man., Canada.	D. F. Michie R. L. Kent	D. S. Swain E. Anderson

ROBERTSON, ARCHIE M., Ch. Engr., Stewart A. Jellett Co., Philadelphia, Pa.	M. F. Blankin R. C. Morgan	H. B. Hedges S. E. Plewes
ROSS, OTTO C., Proprietor, Ross Power Equipment Co., Indianapolis, Ind.	G. B. Supple W. C. Bevington	S. E. Fenstermaker C. H. Hagedon
SAUNDERS, S. G., Staff Officer (Mech.), Civilian Engrs., H.Q. Southeastern Command, Homes Forces, England.	G. R. Jackson C. S. K. Benham	W. G. Case J. D. Troup
SCHNEIDER, E. W., Owner, Airflow Heating & Ventilating Co., New Orleans, La.	J. S. Burke L. V. Cressy	J. J. Joyce *E. E. Brondell
SHREEVE, L. DALE, Refrig. & Air Cond. Engr., Gen. Purchasing Agent, Knapp Supply Co., Muncie, Ind.	P. G. Pfriem C. W. Stewart	W. A. Russell E. N. Sanbern
SMITH, HAROLD G., Designing & Sales Engr., Aladdin Heating Co., Oakland, Calif.	G. M. Simonson S. W. Terry	N. H. Peterson J. I. Sprott
THOMPSON, PAUL J., Branch Mgr., National Radiator Co., Philadelphia, Pa.	H. Erickson M. F. Blankin	C. F. Dietz A. E. Kriebel
WALDON, O. D., Mfgr's Rep., McDonnell & Miller, Indianapolis, Ind.	M. F. Blankin S. E. Fenstermaker	E. N. McDonnell W. A. Russell
WATKINSON, GERALD H., Jean Brillant, Que., Canada.	L. A. Head G. L. Wiggs	J. R. Depuis W. W. Timmins
WEILAND, CARL C., Pres., Mgr., Central Supply, Indianapolis, Ind.	G. B. Supple S. E. Fenstermaker	J. G. Hayes C. N. Warren
WHYTE, F. J., Technical Advisor, Norris Warming Co., Ltd., London, England.	A. H. Barker W. G. Case	W. W. Nobbs E. K. Campbell
WILE, DANIEL D., Development Dept., Carrier Corp., Syracuse, N. Y.	C. M. Ashley C. H. Flink	H. L. Laube W. H. Carrier
WILSON, CAPT. ARTHUR A., USMCR, Camp Refrigeration Engr., U. S. Marine Corps, Camp Lejeune, New River, N. C.	F. W. Hopkins B. W. Farnes	F. W. Knowles L. R. Graves
WRIGHT, CALVERT C., Prof. Fuel Technology, The Pennsylvania State College, State College, Pa.	*A. W. Gauger *Edward Steidle	E. O. Eastwood E. K. Campbell
YOUNG, GEORGE H., Dist. Mgr., B. F. Sturtevant Co., Boston, Mass.	G. B. Supple W. C. Bevington	S. E. Fenstermaker C. H. Hagedon

---

*Non-member.

Candidates Elected

In the past issues of the Journal of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Committee on Admission and Advancement and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. B-III, Sec. 8, of the By-Laws, the following list of candidates elected:

MEMBERS

ACKERMANN, REYNOLD H., Consulting Engr., Charles S. Leopold, Philadelphia, Pa.

BOOKER, JACK W., Htg., Vent. and Air Cond. Engr., Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.

BRAKHA, M. V., Gen. Mgr., Carrier Egypt, S.A.E., Cairo, Egypt.

BUNNELL, E. W., Dewitt C. Griffin & Associates, Spokane, Wash. *(Reinstatement)*

CHEASLEY, THOMAS C., Fuel Engr., Sinclair Coal Co. & Affiliates, Kansas City, Mo.

COX, EDWARD H., Vice Pres. & Buffalo Mgr., Genesee Heating Service, Inc., Buffalo, N. Y.

DENEILLE, J. LAWRENCE, Eichler Heating Co., St. Louis, Mo. *(Reinstatement)*.

FARNES, BERT W., Owner, B. W. Farnes Co., Portland, Ore. *(Advancement)*

FREIJE, W. F., Engr., Hayes Brothers, Inc., Indianapolis, Ind.

HAPPERFIELD, GILBERT J., Dir., Chandes Engineering Co., Ltd., London, England.

HINNANT, CLARENCE H., Capt., Corps of Engineers, Ft. Meade, Md. *(Advancement)*

KNOX, WALTER, Development Engr., H. D. Conkey Co., Mendota, Ill.

MYTINGER, KENNETH L., Dist. Appeals Chief, W.P.B., New York, N. Y. *(Reinstatement)*

MOULSDALE, THOMAS DEWITT, Heating Engr., Lehigh Valley Oil Co., Allentown, Pa.

ROCHE, AUSTIN O., JR., Mgr. of Mfg., Hoffman Specialty Co., Indianapolis, Ind.

SHEPARD, EDWARD C., Mech. Engr., Federal Shipbuilding & Drydock Co., Newark, N. J. *(Reinstatement)*

ASSOCIATES

ASH, ROBERT S., Lt. (j.g.), United States Naval Reserve, Great Lakes, Ill. *(Advancement)*

BURKES, LLOYD C., Mgr., Barber Colman Co., Rockford, Ill.

GROOM, JOHN W., JR., Elec. Draftsman, Pan American Airways, Inc., Miami, Fla.

CROSS, WILLIAM D., Mech. Engr., Sherman Sleeper Associates, Camden, N. J.

HALEY, R. T., Minneapolis Gas Light Co., Minneapolis, Minn. *(Reinstatement)*

LOESER, CHESTER M., Secretary, Elizabeth Cornice Works, Inc., Elizabeth, N. J.

MAYLARD, JOHN B., Ass't Regional Reconditioning Supr., U. S. Home Owners Loan Corp., Illinois.

MILLER, FREDERICK T. J., Hurst Oil Co., Norfolk, Va.

MILLS, DOREMUS L., Research Engr., Revere Copper & Brass, Inc., Rome, N. Y.

SCOTT, EDWIN E., Representative, Ohio Injector Co., Wadsworth, Ohio.

SLEISTER, PARK E., Fremont, Nebr.

JUNIORS

ECKHARDT, ELROY JR., Partner, James F. O'Neil Plumbing & Heating Co., New Orleans, La.

MCBRIDE, JOSEPH A., Ass't Sec., Frank A. McBride Co., Paterson, N. J.

WILLIAMS, GARLAND E., Hull Drafting Room, Norfolk Navy Yard, Portsmouth, Va.

Officers

President	M. F. BLANKIN
First Vice-President	S. H DOWNS
Second Vice-President	C.-E. A. WINSLOW
Treasurer	E. K. CAMPBELL
Secretary	A. V. HUTCHINSON
Technical Secretary	CARL H. FLINK

Council

M. F. BLANKIN, *Chairman* S. H. DOWNS, *Vice-Chairman*

Three Years: J. F. COLLINS, JR., JAMES HOLT, E. N. MCDONNELL, T. H. URDAHL.

Two Years: L. G. MILLER, A. J. OFFNER, A. E. STACEY, JR., B. M. WOODS.

One Year: E. O. EASTWOOD, A. P. KRATZ, W. A. RUSSELL, L. P. SAUNDERS.

Council Committees

Executive—E. O. Eastwood, *Chairman*, A. P. Kratz, E. N. McDonnell.

Finance—J. F. Collins, Jr., *Chairman*, C.-E. A. Winslow, B. M. Woods.

Membership—E. K. Campbell, *Chairman*, A. J. Offner, W. A. Russell.

Meetings—S. H. Downs, *Chairman;* James Holt.

Standards—L. P. Saunders, *Chairman;* L. G. Miller, T. H. Urdahl.

Advisory Council

E. O. Eastwood, *Chairman;* Homer Addams, D. S. Boyden, W. H. Carrier, S. E. Dibble, W. H. Driscoll, W. L. Fleisher, H. P. Gant, F. E. Giesecke, E. Holt Gurney, L. A. Harding, H. M Hart, C. V. Haynes, E. Vernon Hill, John Howatt, W. T. Jones, D. D. Kimball, G. L. Larson, S. R Lewis, Thornton Lewis, J. F. McIntire, F. B. Rowley and A. C. Willard.

Special Committees

Admission and Advancement: E. P. Heckel, *Chairman* (*one year*); T. T. Tucker (*two years*); H. Berkley Hedges (*three years*).

ASHVE-ASTM-ASRE-NRC Committee on Thermal Conductivity—F. C. Houghten, *Chairman;* C. B. Bradley, H. C. Dickinson, R. H. Heilman, E. R. Queer, F. B. Rowley, T. S. Taylor, G. B. Wilkes.

ASHVE-IES Joint Committee on Lighting and Air Conditioning—P. M. Rutherford, Jr., *Chairman;* W R. Beach, B. C. Candee, W. G. Darley, Bruce Jensen, C. L. Kribs, Jr.

Chapter Development Committee—W. A. Russell, *Chairman;* Albert Buenger, C. E. Price.

Chapter Relations—J. F. Collins, Jr., *Chairman;* L. P. Saunders, H. E. Sproull.

Constitution and By-Laws—L. T. Avery, *Chairman;* M. W. Bishop, R. A. Miller.

F. Paul Anderson Award—S. H. Downs, *Chairman;* Tom Brown, F. E. Giesecke, L. L. Lewis and F. B. Rowley.

Guide Publication—P. D. Close, *Chairman;* Thomas Chester, John James, S. Konzo, C. S. Leopold.

Publication—C. H. B. Hotchkiss, *Chairman* (*one year*); J. H. Walker (*two years*); L. E. Seeley (*three years*).

War Service—John Howatt, *Chairman;* W. H. Driscoll, E. N. McDonnell, L. E. Seeley, B. M. Woods.

Nominating Committee

Chapter	*Representative*	*Alternate*
Atlanta	T. T. Tucker	L. F. Kent
Cincinnati	M. E. Mathewson	E. W. McNamee
Connecticut	L E. Seeley	H E. Adams
Delta	G. E. May	G. C. Kerr
Golden Gate	B. M. Woods	
Illinois	E. M. Mittendorff	A. O. May
Iowa	F. E. Triggs	C. W. Helstrom
Kansas City	L. T. Mart	M M. Rivard
Manitoba	Ivan McDonald	Einar Anderson
Massachusetts	E. G. Carrier	A. C. Bartlett
Michigan	M. B. Shea	S. S. Sanford
Minnesota	R. E. Backstrom	William McNamara
Montreal	G. P. Ste-Marie	R. R. Noyes
New York	H. H. Bond	C. S. Koehler
Nebraska	B. G. Peterson	W. R. White
North Carolina	F. E. P. Klages	Arvin Page
North Texas	T. H. Anspacher	
Oklahoma	E. T. P Ellingson	E F. Dawson
Ontario	V. J. Jenkinson	H. R. Roth
Oregon	B. W. Farnes	
Pacific Northwest	R. D. Morse	E. H. Langdon
Philadelphia	H. H. Mather	Edwin Elliot
Pittsburgh	E. C. Smyers	E. H. Riesmeyer, Jr.
St. Louis	C. F. Boester	M. F. Carlock
South Texas	J. A. Walsh	A. J. Rummel
Southern California	W. O. Stewart	Leo Hungerford
Washington, D. C.	J. W. Markert	F. A. Leser
Western Michigan	T. D. Stafford	L. G. Miller
Western New York	H. C. Schafer	S. M. Quackenbush
Wisconsin	C. H. Randolph	Ernest Szekely

Officers of Local Chapters

Atlanta: Organized, 1937. Headquarters, Atlanta, Ga. Meets, First Monday. President, A. H. Koch, 3687 Peachtree Rd. Secretary, L. F. Lawrence, Jr., 304-101 Marietta St., Atlanta 3.

Cincinnati: Organized, 1932. Headquarters, Cincinnati, O. Meets, Second Tuesday. Honorary President, Capt. C. E. Hust. President, Albert Buenger, Hotel Gibson. Secretary, E. J. Richard, 2137 Reading Rd., Cincinnati 2.

Connecticut: Organized, 1940. Headquarters, New Haven, Conn. President, C. J. Lyons, Wilson Ave., S. Norwalk. Secretary, J. R. Smak, 160 Morehouse Highway, Fairfield.

Delta: Organized, 1939. Headquarters, New Orleans, La. Meets, Second Tuesday. President, L. V. Cressy, 423 Baronne St., New Orleans 13. Secretary, J. S. Burke, 317 Baronne St., New Orleans 9.

Golden Gate: Organized, 1937. Headquarters, San Francisco, Calif. Meets, First Wednesday. President, R. A. Folsom, 150 Hooper St. Secretary, R. B. Holland, 1275 Folsom St.

Illinois: Organized, 1906. Headquarters, Chicago, Ill. Meets, Second Monday. President, Chas. E. Price, Room 1605, 6 N. Michigan Ave., Chicago 2. Secretary, C. M. Burnam, Jr., Room 1605, 6 N. Michigan Ave., Chicago 2.

Indiana: Organized, 1943. Headquarters, Indianapolis, Ind. President, S. E. Fenstermaker, 937 Architects and Builders Bldg. Secretary, C. W. Stewart, 1001 York St.

Iowa: Organized, 1940. Headquarters, Des Moines, Ia. Meets, Second Tuesday. President, C. W. Helstrom, 1614 Thompson. Secretary, B. E. Landes, 1603 47th St., Des Moines 10.

Kansas City: Organized, 1917. Headquarters, Kansas City, Mo. Meets, Second Monday. President, L. T. Mart, 3001 Fairfax Rd., Kansas City, Kans. Secretary, F. S. Pexton, 824 Grand Ave., Kansas City 13, Mo.

Manitoba: Organized, 1935. Headquarters, Winnipeg, Man. Meets, Third Thursday. President, F. L. Chester, 179 Bannatyne Ave. Secretary, F. T. Ball, 810 9th Ave., W., Calgary, Alta. Acting Secretary, Einar Anderson, 152 Bannerman Ave., Winnipeg.

Massachusetts: Organized, 1912. Headquarters, Boston, Mass. Meets, Third Tuesday. President, E. G. Carrier, 704 Statler Bldg. Secretary, R. T. Kern, 51 Claflin St., Leominster.

Michigan: Organized, 1916. Headquarters, Detroit, Mich. Meets, First Monday after 10th of month. President, S. S. Sanford, 2000 Second Ave. Secretary, A. E. Knibb, 1003 Maryland Ave., Detroit 30.

Minnesota: Organized, 1918. Headquarters, Minneapolis, Minn. Meets, First Monday. President, D. B. Anderson, 1999 Pinehurst Ave., St. Paul. Secretary, R. E. Gorgen, Wesley Temple Bldg., Minneapolis.

Montreal: Organized, 1936. Headquarters, Montreal, Que. Meets Third Monday. President, F. A. Hamlet, 1010 St. Catherine St., W. Secretary, R. R. Noyes, 630 Dorchester St., W.

Nebraska: Organized, 1940. Headquarters, Omaha. Meets, Second Tuesday. President, G. E. Merwin, 5012 Parker St. Secretary, E. F. Adams, 1227 So. 52nd St.

New York: Organized, 1911. Headquarters, New York, N. Y. Meets, Third Monday. President, R. A. Wasson, 500 Fifth Ave. Secretary, P. G. Griess, 189 Walnut Ave., Bogota, N. J.

North Carolina: Organized, 1939. Headquarters, Durham, N. C. Meets, Quarterly. President, F. J. Reed, 263 College Station. Secretary, C. Z. Adams, 312 Piedmont Bldg., Greensboro.

North Texas: Organized, 1938. Headquarters, Dallas, Tex. Meets, Second Monday. President, M. L. Brown, 3500 Commerce St. Secretary, E. T. Gessell, Thomas Bldg.

Northern Ohio: Organized, 1916. Headquarters, Cleveland, O. Meets, Second Monday. President, P. D. Gayman, 2142 E. 19th St. Secretary, G. B. Priester, Case School of Applied Science, Cleveland 6.

Oklahoma: Organized, 1935. Headquarters, Oklahoma City, Okla. Meets, Second Monday. President, E. F. Dawson, University of Oklahoma, Norman. Secretary, E. T. P. Ellingson, 314 Savings Bldg., Oklahoma City 2.

Ontario: Organized, 1922. Headquarters, Toronto, Ont. Meets, First Monday. President, W. C. Kelly, 602 King St., W. Secretary, H. R. Roth, 57 Bloor St., W.

Oregon: Organized, 1939. Headquarters, Portland, Ore. Meets, Thursday after First Tuesday. President, J. A. Freeman, 1623 S. E. 11th Ave. Secretary, G. H. Risley, 516 S. W. Oak St., Portland 4.

Pacific Northwest: Organized, 1928. Headquarters, Seattle, Wash. Meets, Second Tuesday. President, R. D. Morse, 414 Vance Bldg, Seattle 1. Secretary, J. D. Sparks, 7331 W. Green Lake Way. Seattle 3.

Philadelphia: Organized, 1916. Headquarters, Philadelphia, Pa. Meets, Second Thursday. President, Edwin Elliot, 560 N. 16th St. Secretary, E. H. Dafter, Room 2211, 12 S. 12th St., Philadelphia 7.

Pittsburgh: Organized, 1919. Headquarters, Pittsburgh, Pa. Meets, Second Monday. President, G. G. Waters, 1841 Oliver Bldg. Secretary, E. H. Riesmeyer, Jr., 231-33 Water St., Pittsburgh 22.

St. Louis: Organized, 1918. Headquarters, St. Louis, Mo. Meets, First Tuesday. President, C. F. Boester, 101 E. Essex, Kirkwood. Secretary, B. C. Simons, Rm. 706, 4030 Chouteau, St. Louis 10.

South Texas: Organized, 1938. Headquarters, Houston, Texas. Meets, Third Friday. President, A. M. Chase, Jr., Box 359. Secretary, A. F. Barnes, 602 Kirby Bldg., Houston 2.

Southern California: Organized, 1930. Headquarters, Los Angeles, Calif. Meets, Second Wednesday. President, W. O. Stewart, 153 W. Avenue 34. Secretary, Maron Kennedy, 5051 Santa Fe Ave.

Washington, D. C.: Organized, 1935. Headquarters, Washington, D. C. Meets, Second Wednesday. President, S. L. Gregg, 4828 Edgemoor Lane, Bethesda, Md. Secretary, A. S. Gates, Jr., 111 County Rd., Kensington, Md.

Western Michigan: Organized, 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. President, C. H. Pesterfield, Michigan State College, East Lansing. Secretary, V. H. Hill, 2111 Colvin Court, Lansing 10.

Western New York: Organized, 1919. Headquarters, Buffalo, N. Y. Meets, Second Monday. President, S. M. Quackenbush, 117 W. Tupper St. Secretary, Herman Seelbach, Jr., 45 Allen St.

Wisconsin: Organized, 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. President, F. W. Goldsmith, 513 E. Day Ave. Secretary, E. W. Gifford, 611 N. Broadway.

Committee on Research

C. M. Ashley, *Chairman*

H. J. Rose, *Vice-Chairman*

Cyril Tasker, *Director of Research*

C. M. Humphreys, *Acting Director, Research Laboratory*

J. H. Walker, *Technical Adviser*

A. C. Fieldner, *Ex-Officio Member*

Three Years: H. J. Rose, L. P. Saunders, L. E. Seeley, A. E. Stacey, Jr.

Two Years: C. F. Boester, John A. Goff, W. E. Heibel, C. A. McKeeman, C.-E. A. Winslow.

One Year: C. M. Ashley, M. K. Fahnestock, H. King McCain, F. C. McIntosh, T. H. Urdahl.

Executive Committee: C. M. Ashley, *Chairman;* F. C. McIntosh, M. K. Fahnestock, H. J. Rose, T. H. Urdahl.

Finance Committee: E. N. McDonnell, *Chairman.*

Due to the Government order restricting the use of printing paper, the Index for the ASHVE Journal Section, January-December 1943, Vol. 15, Nos. 1-12, will be published in a separate pamphlet (limited edition) and will be furnished to members, only upon application. Your request should be sent promptly to the Secretary, 51 Madison Ave., New York (10), N. Y.

Technical Advisory Committees

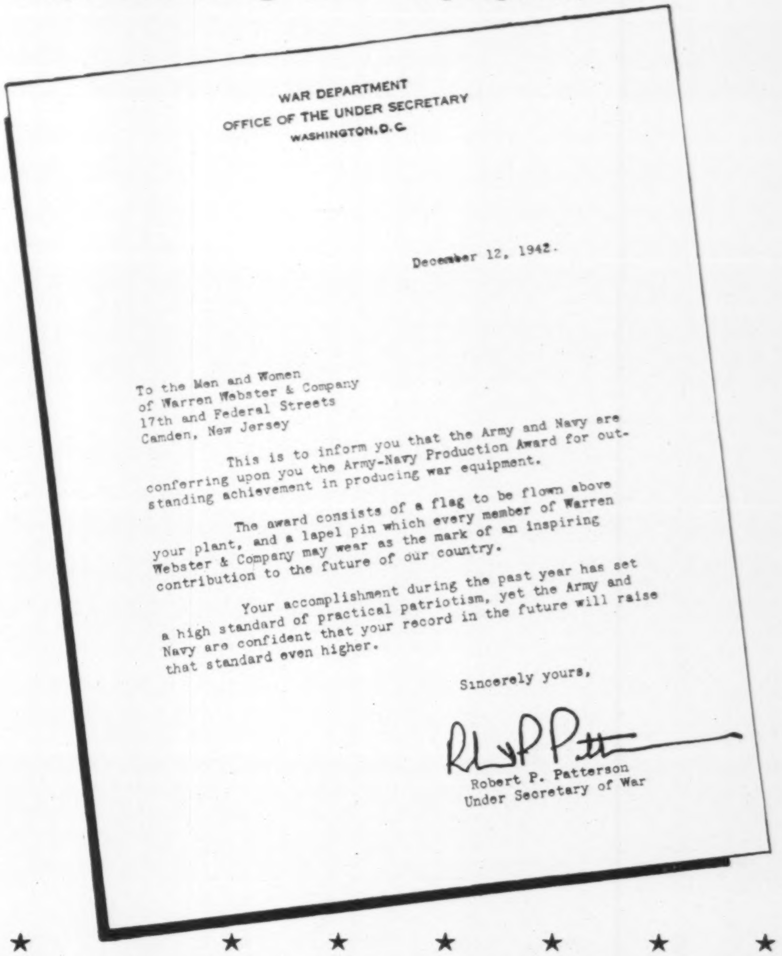
1. *Sensations of Comfort:* Thomas Chester, *Chairman;* N. D. Adams, C. R. Bellamy, G. D. Fife, E. P. Heckel, F. C. McIntosh,* A. B. Newton, B. F. Raber.
2. *Physiological Reactions:* R. W. Keeton, M.D., *Chairman.*
3. *Removal of Atmospheric Impurities:* R. S. Dill, *Chairman;* J. J. Burke, J. M. DallaValle, Leonard Greenburg, M.D., Theodore Hatch, W. C. L. Hemeon, L. R. Koller, C. A. McKeeman,* F. H. Munkelt, H. C. Murphy, G. W. Penney, E. B. Phelps, F. B. Rowley, J. B. Smith, W. O. Vedder, J. H. Waggoner, R. P. Warren, W. F. Wells.
4. *Radiation and Comfort:* J. C. Fitts, *Chairman;* E. L. Broderick, R. E. Daly, L. N. Hunter, F. W. Hutchinson, A. P. Kratz, John James, C. S. Leopold, D. W. Nelson, G. W. Penney, W. R. Rhoton, T. H. Urdahl.*
5. *Instruments:* D. W. Nelson, *Chairman;* L. M. K. Boelter, E. L. Broderick, R. S. Dill, R. B. Engdahl, A. P. Gagge, J. A. Goff,* J. D. Hardy, A. E. Hershey, F. W. Reichelderfer, G. L. Tuve, C. P. Yaglou.
6. *Weather Design Conditions:* T. H. Urdahl,* *Chairman;* J. C. Albright, H. S. Birkett, P. D. Close, J. F. Collins, Jr., John Everetts, Jr., C. M. Humphreys, H. H. Koster, J. W. O'Neill, F. W. Reichelderfer.
7. *Radiation with Gravity Air Circulation:* M. K. Fahnestock,* *Chairman;* R. E. Daly, R. S. Dill, A. G. Dixon, F. E. Giesecke, H. F. Hutzel, J. P. Magos, J. W. McElgin, J. F. McIntire, W. A. Rowe.
8. *Heat Transfer of Finned Tubes:* W. E. Heibel,* *Chairman;* William Goodman, H. F. Hutzel, Ferdinand Jehle, S. F. Nicoll, R. H. Norris, L. P. Saunders,* R. J. Tenkonohy, G. L. Tuve, D. C. Wiley.
9. *Cooling Load in Summer Air Conditioning:* W. E. Zieber, *Chairman;* John Everetts, Jr., W. F. Friend, R. H. Heilman, John James, C. S. Leopold, C. O. Mackey, A. E. Stacey, Jr.,* G. E. Tuckerman, J. H. Walker,* M. J. Wilson.
10. *Air Distribution and Air Friction:* J. H. Van Alsburg, *Chairman;* S. H. Downs, A. P. Kratz, E. C. Lloyd, R. D. Madison, L. G. Miller, D. W. Nelson, C. H. Randolph, L. P. Saunders,* M. C. Stuart, Ernest Szekely, G. L. Tuve.
11. *Heat Requirements of Buildings:* P. D. Close, *Chairman;* E. K. Campbell, J. F. Collins, Jr., E. F. Dawson, W. H. Driscoll, H. H. Mather, H. K. McCain,* M. W. McRae, C. H. Pesterfield, F. B. Rowley, R. K. Thulman.
12. *Air Conditioning Requirements of Glass:* R. A. Miller, *Chairman;* L. T. Avery, F. L. Bishop, W. A. Danielson, H. C. Dickinson, J. D. Edwards, J. E. Frazier, E. H. Hobbie, C. L. Kribs, Jr., Axel Marin, F. W. Parkinson, W. C. Randall, L. E. Seeley,* L. T. Sherwood, J. T. Staples, H. B. Vincent, G. B. Watkins, F. C. Weinert.
13. *Sound Control:* R. D. Madison, *Chairman;* W. W. Kennedy, V. O. Knudsen, C. H. Randolph, A. E. Stacey, Jr.,* A. G. Sutcliffe, T. A. Walters, R. M. Watt, Jr.
14. *Cooling Towers, Evaporative Condensers and Spray Ponds:* H. B. Nottage, *Chairman;* C. F. Boester,* W. W. Cockins, S. C. Coey, E. H. Kendall, E. R. Ketchum, S. R. Lewis, J. F. Park, S. I. Rottmayer, E. W. Simons, E. H. Taze.
15. *Psychrometry:* J. A. Goff,* *Chairman;* F. R. Bichowsky, W. H. Carrier, H. C. Dickinson, R. S. Dill, A. W. Gauger, William Goodman, A. M. Greene, Jr., L. P. Harrison, F. G. Keyes, A. P. Kratz, D. M. Little, Axel Marin, D. W. Nelson, W. M. Sawdon.
16. *Flow of Fluids Through Pipes and Fittings:* F. E. Giesecke, *Chairman;* T. M. Dugan, S. R. Lewis, L. P. Saunders.*
17. *Fuels:* R. A. Sherman, *Chairman;* R. M. Conner, R. S. Dill, R. B. Engdahl, A. C. Fieldner, L. N. Hunter, S. Konzo, W. M. Myler, Jr., H. J. Rose,* C. E. Shaffer, T. H. Smoot, R. K. Thulman, T. H. Urdahl,* E. C. Webb.
18. *Corrosion:* L. F. Collins, *Chairman;* R. C. Doremus, E. W. Guernsey, G. G. Marvin, A. R. Mumford, L. P. Saunders,* F. N. Speller.
19. *Air Conditioning in Industry:* W. L. Fleisher, *Chairman;* L. T. Avery, A. R. Behnke, M.D., Leonard Greenburg, M.D., W. E. Heibel,* F. C. Houghten, D. E. Humphrey, E. F. Hyde, L. L. Lewis, P. A. McKittrick, R. R. Sayers, M.D., R. M. Watt, Jr., H. E. Ziel.
20. *Sorbents:* F. R. Bichowsky, *Chairman;* O. D. Colvin, F. Dehler, John Everetts, Jr., Ralph Fehr, J. A. Goff,* W. R. Hainsworth, C. H. B. Hotchkiss, J. C. Patterson, G. L. Simpson.
21. *Insulation:* E. R. Queer, *Chairman;* J. D. Edwards, F. G. Hechler, H. K. McCain,* Paul McDermott, W. T. Miller, H. C. Robinson, F. B. Rowley, G. L. Tuve, J. H. Waggoner, G. B. Wilkes.
22. *Heavy Duty Air Heating Furnaces:* E. K. Campbell, *Chairman;* H. D. Campbell, K. T. Davis, A. P. Kratz, W. J. MaGirl, A. A. Olson, B. B. Reilly, H. J. Rose,* H. A. Soper.

---

*Member of Committee on Research.

HONORING THE MEN AND WOMEN OF WARREN WEBSTER & COMPANY

"... for outstanding achievement in producing war equipment."



WAR DEPARTMENT
OFFICE OF THE UNDER SECRETARY
WASHINGTON, D. C.

December 12, 1942.

To the Men and Women
of Warren Webster & Company
17th and Federal Streets
Camden, New Jersey

This is to inform you that the Army and Navy are conferring upon you the Army-Navy Production Award for outstanding achievement in producing war equipment.

The award consists of a flag to be flown above your plant, and a lapel pin which every member of Warren Webster & Company may wear as the mark of an inspiring contribution to the future of our country.

Your accomplishment during the past year has set a high standard of practical patriotism, yet the Army and Navy are confident that your record in the future will raise that standard even higher.

Sincerely yours,

Robert P. Patterson
Robert P. Patterson
Under Secretary of War

This badge of honor will be worn proudly by every employee of Warren Webster & Company. It is a daily reminder that their production at high rate and quality is urgently needed for Victory ... production of Ordnance materials for our fighting men ... production of Webster Steam Heating Equipment for Army and Navy buildings, war plants, ships and other essential uses.

—since 1888
Webster
Systems of Steam Heating

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

WARREN WEBSTER & COMPANY, CAMDEN, N. J.

Pioneers of the Vacuum System of Steam Heating, Representatives in principal U. S. Cities

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Now Serving in Two New Chapels for the Armed Forces . . . RADIANT HEATING and

BYERS WROUGHT IRON

In war, as in peace, Radiant Heating continues to demonstrate its adaptability and versatility. The illustration shows it being installed in one of two new chapels, built for the military forces.

The chapels are 131 feet by 50 feet. The 2½-inch supply lines, 2-inch headers, and ¾-inch coils are all wrought iron, laid on a gravel base and covered with a concrete slab 4 inches to 5 inches in thickness. The system was designed by F. E. Markel, Engineer, Mechanical Department of Robert and Company, Architects. Byers Wrought Iron Pipe was used.

Radiant Heating is receiving particular attention from active architects and engineers today, because of its economy in material requirements. A comparative check recently made on a projected job revealed that metal needed (exclusive of boiler) for a hot water system was 1425 lbs.; for a steam system, 977 lbs.; and for a Radiant Heating system, only 727 lbs. With conservation so important, the ability of Radiant Heating to do the job with *less* makes it an invaluable tool. Further, several Radiant Heating users have reported substantial reductions in comparative fuel requirements—another advantage of particular value today.

Questions of availability and delivery naturally arise in connection with all jobs today, when allocations must be made on the basis of greatest individual contribution to war effort. When you have such a question, we urge that you do not depend on rumor or hearsay, but contact a Byers Field Service Representative, the nearest District Office, or the Home Office in Pittsburgh. You can thus be sure of an authoritative answer.

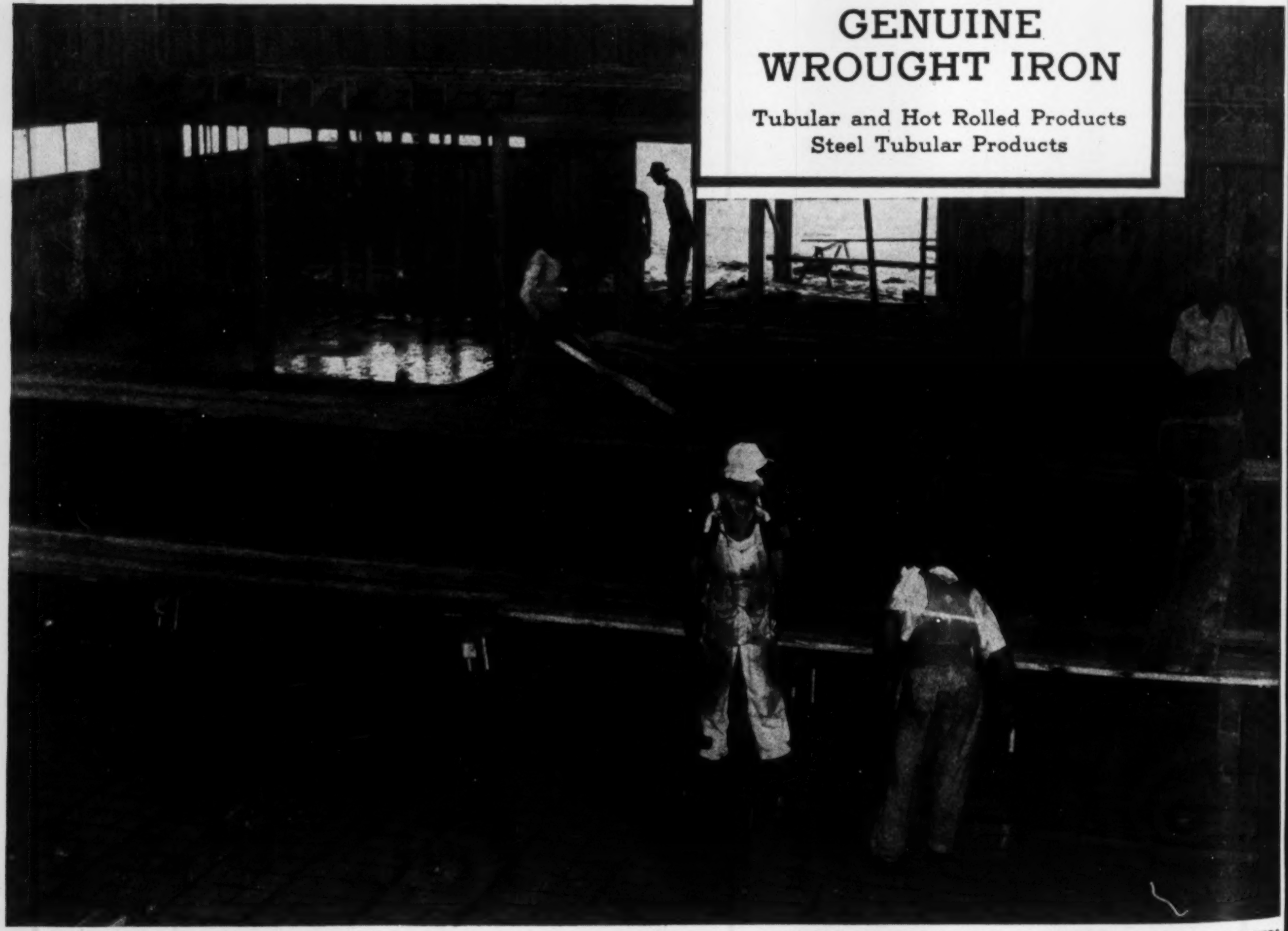
If you do not have our technical bulletin, "Byers Wrought Iron for Radiant Heating Installations" . . . or if any of your associates who are concerned with heating do not have one . . . we will be glad to send you a copy or copies, on request.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Corrosion costs you MORE than Wrought Iron

LOOK FOR THE PIPE WITH THE RED SPIRAL STRIPE

BYERS
GENUINE WROUGHT IRON
Tubular and Hot Rolled Products
Steel Tubular Products



CHAPELS FOR THE ARMED FORCES . ROBERT AND COMPANY · ARCHITECTS AND ENGINEERS

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page.

New Pump Unit

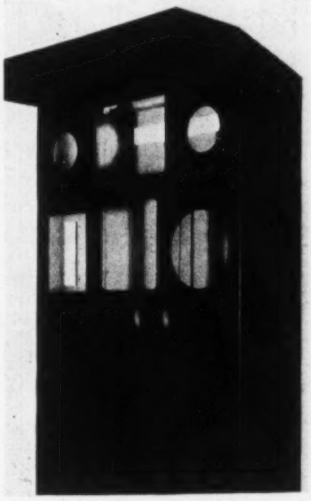
No. 2380—A new pump for clear liquid service, in capacities from 10 to 500 gpm, known as the "Type SCV," has been announced. Among the more common services for which it is offered are cold and hot water circulation, brine circulation, air conditioning systems, sprinkler systems, boiler feeding, pressure boosting, and for the food, brewing and other processing industries.

Among the features of these pumps are the small amount of floor space required, the simplified lubrication, the registering of the motors in motor stands high above the floor or the mounting base, and the design for perfect rotor alignment, says the maker. The pump rotor is easily removed without disturbing suction or discharge connections.

The smaller sizes, units with discharges from 1 to 2 in. inclusive, have standard threaded pipe tap connections, and those with discharges 2½ in. and larger have standard 125 psi flanged connections.—Economy Pumps, Inc., 1000 Weller Ave., Hamilton, Ohio.

Instrument and Control Panels

No. 2381—To conserve sheet steel, instrument and control panels made of "Masonite," reinforced with steel angles, are available. The body of the panel is ⅝ in. thick and is bolted to a framework of 3 x 3 angle steel. Braces of 2 x 2 angle steel reinforce the center of the panel to insure adequate support for the instruments and controllers. The canopy and doors are 5/16 in. thick.



The material is hard and takes a finish comparable to steel. The entire panel is first gone over with a sanding surfacer, after which the priming coat is sprayed on and rubbed down to a smooth base. This is followed by several coats of undercoater sanded and rubbed. After a thorough drying the finishing coats of black lacquer are sprayed on. The inside is finished with two coats of gray lacquer.—Hays Corp., E. 8th St., Michigan City, Ind.

Antirust, Anticorrosion Agent

No. 2382—"Rustbuster No. 3" is a recently developed antirust and anticorrosion agent for protecting low and high pressure boilers and each part of their complete systems. According to the manufacturer, it maintains a noncorrosive pH in the boiler water; inhibits steam vapor throughout the entire cycle; eliminates corrosion around valves, fittings, and packings; protects radiators, tanks, indirect heaters, evaporators, etc.; and prevents rust, corrosion, and accumulation of corrosion products in condensate return lines. Thus it is offered as a rustproofing agent for the entire heating plant.

The product is said to be harmless to copper, brass, iron, and various kinds and types of steel; it is not inflammable and has no offensive odor as a concentrate, in solution, or in the vapor phase, it is stated.

A companion product, "Oilbuster," is recommended by the maker for use in many cases to clean and scour a boiler and system before the initiation of the feedwater treatment.—Cannon Chemical Co., 210 Broadway, Everett, Mass.

Cork Supply Increases

No. 2383—The supply of cork on hand in this country is now twice that of normal times and more than double that on hand when it was placed under mandatory priority control by the War Production Board in June, 1941, according to the Armstrong Cork Co. in a statement issued last month. With this stockpile in reserve and a still larger supply in prospect through probable increased shipments from North Africa, Spain, and Portugal, the government is expected to relax its

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [1-43]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature.

(Circle each number in which you are interested):

2380	2381	2382	2383	2384	2385	2386	2387	2388	2389
2390	2391	2392	2393	2394	2395	2396			
4350	4351	4352	4353	4354	4355	4356	4357	4358	4359
4360	4361	4362	4363	4364	4365				

Name .... Title ....

Company ....

Address ....

City .... State............

WHITE-RODGERS THERMOSTATS

White-Rodgers Series 150 Thermostats are being extensively used in War Plants, Naval Stations and Army Camps for the control of unit heating and cooling equipment. The reliable performance of these heavy-duty line-voltage thermostats is due to exceptionally sturdy construction plus the time-tested accuracy of the Hydraulic-Action principle of temperature control.

HYDRAULIC ACTION CONTROL

White-Rodgers Series 180 Thermostats are widely used in similar military and naval installations where lower current ratings are permissible. An improved type bimetallic element, extremely sensitive to temperature changes, operates a double-contact switch mechanism housed in a protective steel case.

WHITE-RODGERS ELECTRIC CO.

Controls for Heating • Refrigeration • Air-Conditioning

1205a CASS AVENUE • ST. LOUIS, MISSOURI

restrictions on the use of cork for insulat on

Trends in this direction have been indicated The WPB conservation division has moved co group 2 to group 3 in the material substituti supply list, which now classifies cork as one of terials available in substantial quantities and mended as substitutes for critical materials.

The Army and Navy munitions board, in now permits corkboard to be used for insulati poses in temporary structures, eliminating a directive allowing the use of corkboard for in only in structures built for five years' or more tion.

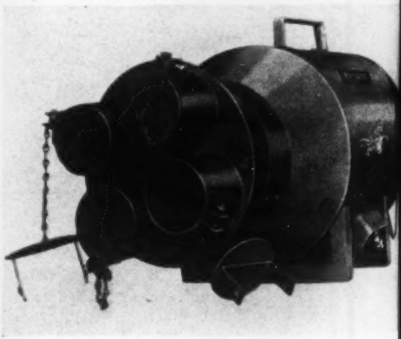
When the government placed cork under ma priority control last year, there was no im shortage of cork, but it was deemed important non-essential usage and thus create a stockpile to meeting future demands for war production an essential uses. Corkboard and cork covering industrial and war needs were included in the u were regarded as essential to the war effort.

During the year and a half since cork was under priority control, it has been furnished quantities for insulation work in forts, camps, b proving grounds, arsenals, ordnance plants, pla ducing synthetic fibers and synthetic rubber, gasoline and lubricating oils, and for other e work.

Despite consumption for such vital war need ments of cork arriving every month from the pr countries have resulted in the creation of a la serve stockpile.

Portable Ventilation Unit

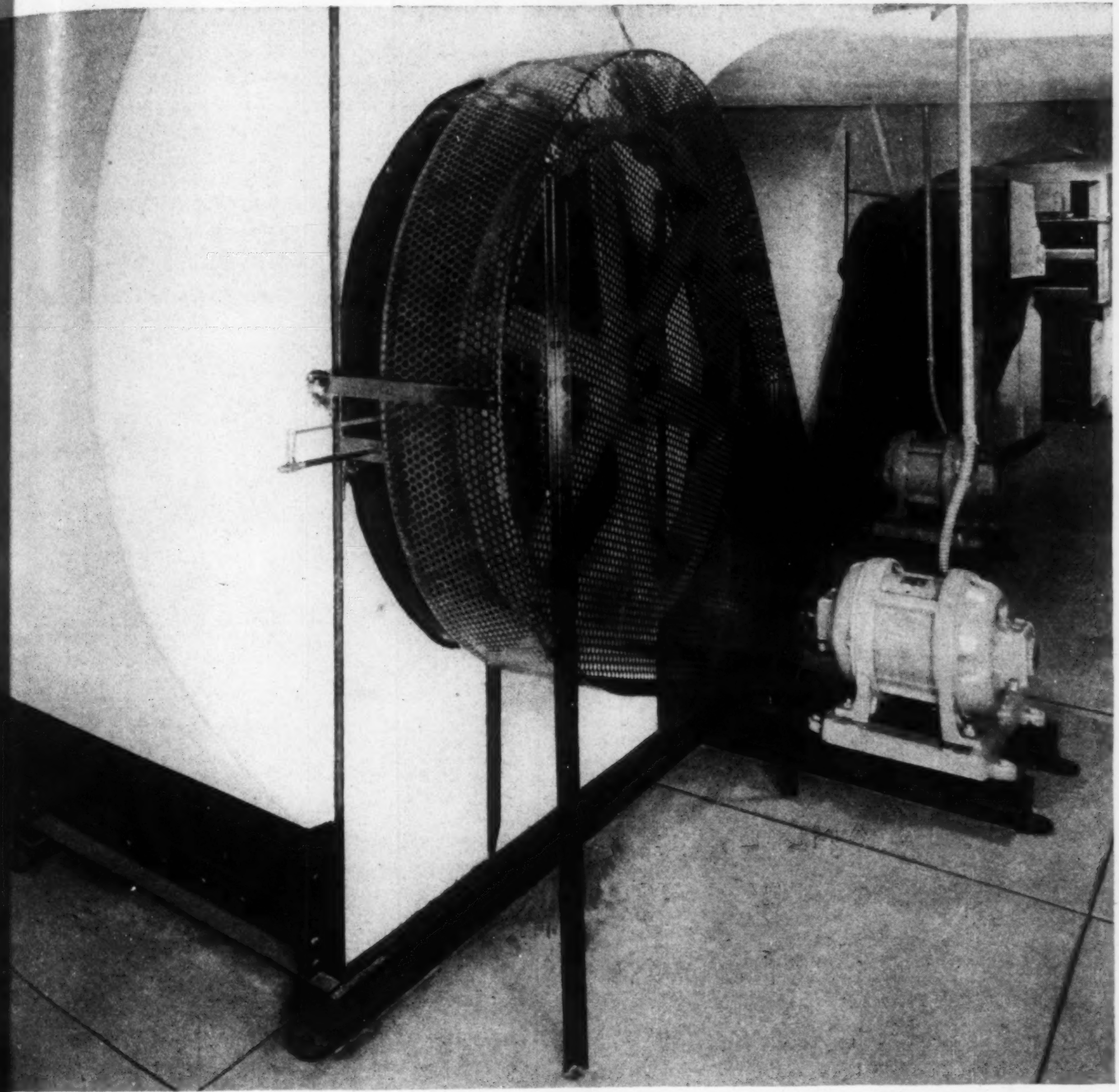
No. 2384—A new small portable unit to el gases, fumes, etc. from closed in places—such holds, welding rooms, tunnels, vaults, and basements — is known as the "Octopus Jr." According to the manufacturer, it sucks or blows 2000 cfm, operates in an tion, and is powered by a ¾ hp ball bearing mo



It has adaptors for three 4 in. nozzles, or fo nozzles, for flexible hose, with caps to close the not in use. The entire unit can be hung into manhole.—Chelsea Fan & Blower Co., Inc., 1206 St., Irvington, N. J.

Vertical Rotary Pump

No. 2385—A new rotary pump, vertically and powered by a 15 hp gearhead motor, is pumping diesel fuel on combat and escort craft. ever, due to the small floor space required for m this same unit has been adapted for use in in



Stop Vibration with Vibration Proof Fan Bases

is fan and motor base is a rigid structural steel assembly, drilled and ed for fan and motor frame foundation with built-in isolation units of pure al cork or rubber-in-shear. These have been used over a period of sev- years under all conditions of installa- and have proven highly successful. built-in isolation units are of a size and ribution, accurately calculated for each assuring maximum resiliency and oth operation. There is a continuous structural steel member running the th of the fan parallel to the drive and ding under the motor. This continu- member eliminates any possibility of distortion and assures accurate belt alignment, since all bases are factory assembled from certified fan, motor and drive prints for the job. An important feature of these bases is that the continuous structural member between fan and motor is located *on top* of the isolation material or system, and not under the resilient supports. This design prevents the fan and motor from vibrating, each at its own frequency independent of the other, with a resulting belt whip as well as solving the problem of starting torque. As shown in the picture, a level supporting surface is provided under the motor frame around its entire perimeter, and this portion of the base is arc-welded to the fan portion of the base.

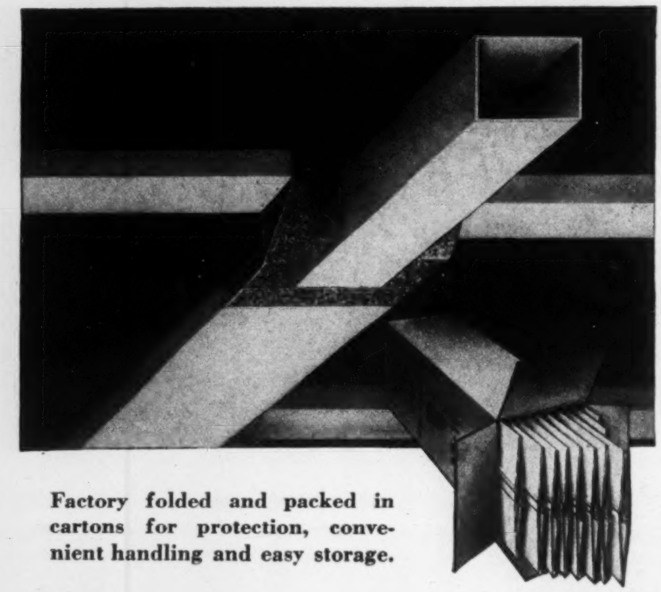
In addition to fan and motor bases there is a complete line of unit isolators and bases for compressors, direct connected blowers, etc., all designed for the equipment. Write now for complete descriptive literature and prices. Please specify make of fans and compressors most frequently used and the data will be supplied accordingly. Send your letter to The Vibration Eliminator Company 8-23 Astoria Boulevard, Astoria, L. I., New York.

VIBRATION ELIMINATOR

S-S-D

SAL-MO SUPPLY DUCT

NEW NON-METALLIC MATERIAL
FOR SUPPLY AND RETURN DUCTS



Factory folded and packed in cartons for protection, convenient handling and easy storage.

APPROVED AND LISTED BY
UNDERWRITER'S LABORATORIES, INC.

SAL-MO Supply Duct (S-S-D) is the new conduit material for constructing both supply and return ducts for warm air heating, ventilating and air conditioning systems. It saves metal, permitting many installations that would otherwise be impossible because of the metal shortage.

Ducts, both supply and return, made from S-S-D are safe, insulated and fuel saving. Leading independent laboratories, including Underwriter's Laboratories, Inc., have proved that S-S-D possesses a wide margin of safety.

S-S-D is factory fabricated and packed in cartons for ease in handling, shipping and storing. Saves time in erection.

Available for prompt shipment in any quantity, and in a complete range of sizes for domestic and industrial requirements. It is also furnished in flat sheets.

See Your Jobber or Write to—

SALL MOUNTAIN COMPANY
176 W. Adams St. DEPT. F-2 CHICAGO, ILL.

plants requiring the transfer of oils and other abrasive liquids, says the manufacturer.

The general specifications are as follows: Capa 100 gpm at a pressure of 100 psi, handling diesel pumping unit all bronze construction; motor is sta ard gearhead type. One thousand seven hundred seventy rpm reducing to 440 rpm on the drive sha base is fabricated steel, designed for bottom and anchorage in mounting.—Blackmer Pump Co., 19 Century Ave., S. W., Grand Rapids, Mich.

Improved Welding Machine

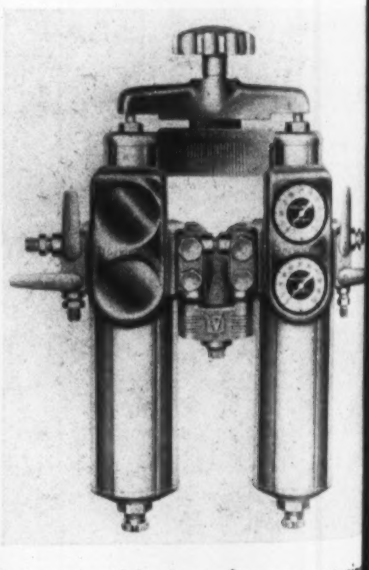
No. 2386—A new a-c transformer type welding chine combines exceptional safety with improved ating efficiency, according to the manufacturer. Known as the "Bumble Bee" a-c welder, its most interesting feature is said to be its low open circuit voltage of 42 volts.

Two primary coils are used instead of one, with a magnetic contactor in the circuit of one primary. Each primary contributes approximately 42 volts to the total open circuit voltage, which is actu 84 to 85 volts. However, when the machine is idle, primary is automatically cut out, restricting the o circuit value to 42 volts. As soon as the electrode tacts the work, the second primary is thrown into circuit, and if there were not a dead short, the volt would be 84-85 volts.

When the operator draws an arc, this open cir potential of 84-85 volts enables him to establish arc quickly and begin welding.—Wilson Welder Metals Co., Inc., 60 E. 42nd St., New York, N. Y.

Heavy Duty Air Transformer

No. 2387—On many automatic spray painting inst ations and in other operations where a large volume regulated clean air is needed, an air transformer of a capacity considerably greater than that of the standard type is required. To meet these conditions a new heavy duty air transformer with a capacity in excess of 100 cfm has been developed.



Though both function independently, the two pressure regulators in this transformer are si taneously controlled by a single knob, making adj ment quick, easy, and positive. The filtering and densing mechanisms are a permanent, all metal type which do not require replacement. The regulator diaphragms are made of reinforced, oilproof, synthetic rubber.

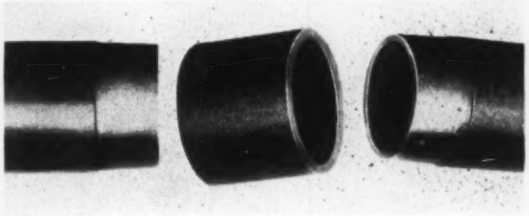
Connection to the main air line is made at a single inlet port. — The DeVilbiss Co., 300 Phillips Ave., Toledo, Ohio.

Lead Calking Ferrules

No. 2388—Continuing research for means to accomplish durable, sanitary piping installations with minimum use of critical materials, hard lead calking ferrules have been developed and tested.

Of noncritical material, these ferrules can be welded or wiped to lead pipe. They are amply strong and rigid to stand calking into cast iron pipe with either lead wool or poured lead, it is stated. They are to be made in 2, 3, and 4 in. sizes. —Lead Industries Association, 420 Lexington Ave., New York, N. Y.

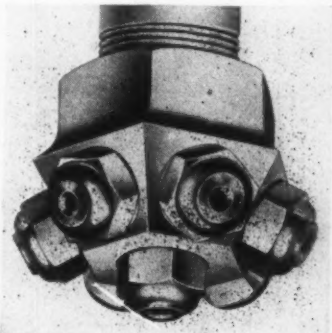
Wood Cellulose Pipe



No. 2389—In view of the metal shortage, interest has been shown in the possibilities of fiber conduit such as "Bermico." In its production, wood cellulose fibers are built up and heat treated to form tubes with a solid homogeneous wall structure. These tubes are then impregnated by a special process to produce a chemically inert, light weight pipe with high mechanical strength and water resistance.

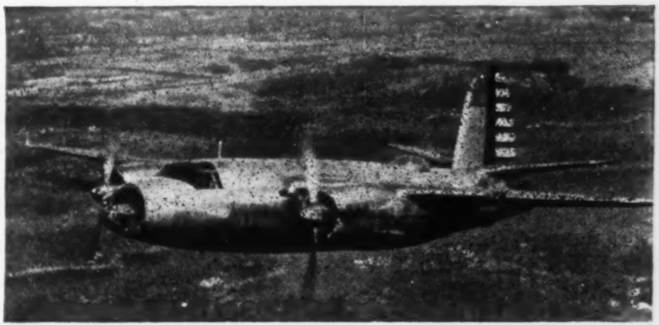
Millions of feet of this product are put under ground each year for the installation of electrical cables, says the maker. It is also being used as a protective jacket to prolong the life of metal pipe exposed to corrosive action of liquids or gases.—Brown Co., 500 Fifth Ave., New York, N. Y.

Fog Nozzle for Fire Fighting



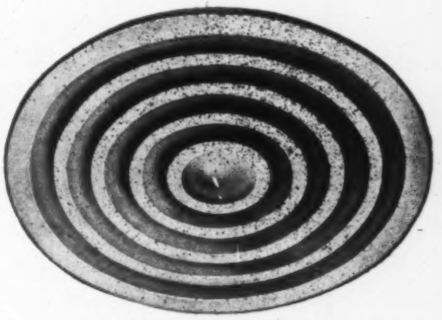
No. 2390 — Increased industrial and maritime fire hazards and the possibility of incendiary bombing attacks have stimulated efforts to provide more efficient means of fighting fire. A recent product of this search is the line of "Fogjet" nozzles.

Specialists in spraying nozzle manufacture have designed both a fog laying and fog throwing type. Both nozzles do a thorough job of breaking a water stream



AEROFUSE OUTLET
PROVIDES
HEAT AND VENTILATION
TO AMERICA'S HEROES
In the Air and on the Ground

Tuttle & Bailey are particularly proud that the Aerofuse Outlet has been selected by so many architects and engineers to provide heat and ventilation or air conditioning in so many projects important to America's all-out war effort. In planes, in plants that build planes, and guns and tanks and the million and one other necessities of modern war, engineers have found that the pre-determined results and simple selection system have made the Aerofuse Outlet the first choice when speed of construction is so often a vital element. Send for catalog with full engineering data.



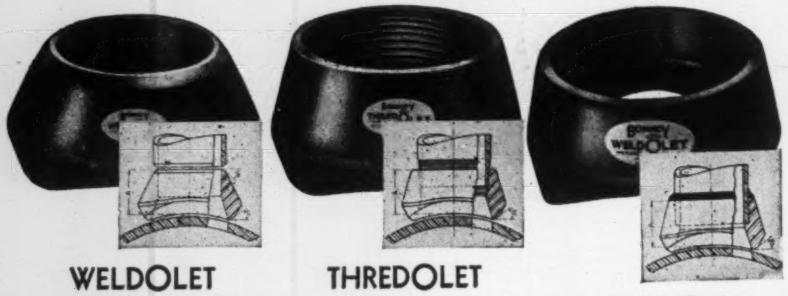
TYPE S OUTLET

T & B

TUTTLE & BAILEY, Inc.
NEW BRITAIN, CONN.
NEW YORK CHICAGO PHILADELPHIA HOUSTON

Speed up
branch outlet installations
without removing the main pipe

These are the fittings that do it



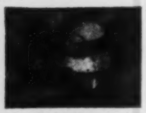
WELDOLET
THREDOLET
Socket-End
WELDOLET

BECAUSE 90° welded, right-angle branch pipe outlets are made with WeldOlets, ThredOlets and/or Socket-End WeldOlets without any threading, forming or fitting of the main pipe, installations of branch lines is speeded up and costs of installation reduced.

Because of their design and ease of application, their installation in existing lines is in many cases possible without even removing a section of the main pipe.

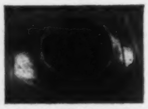
They provide leakproof junctions of full pipe strength that reduce turbulence and friction to a minimum. Available from stock of drop forged steel for all standard pipe sizes up to 12" x 12" and on special order up to 24" x 24". For special applications they can be furnished in Monel, Everdur, Toncan Iron, wrought iron, etc.

They are easily installed



Mark center lines. Tack the fitting into place. The fitting is the templet.

Then weld the fitting to the main pipe.



Removal of the button permits inspection of the inside of the joint, impossible with any other fittings.

Then attach the branch pipe. A trim, leakproof junction of full pipe strength results.

This book tells how

Branch Pipe Outlets
with
BONNEY
WELDOLETS
THREDOLETS
SOCKET-END
WELDOLETS

It tells in detail: their purpose; what they are; how to make welded, right-angle branch pipe outlets stronger, better and at less cost; how they reduce turbulence and friction; how to make a right-angle outlet in six easy steps; how they fill every piping need for new construction or maintenance; their adaptability to shop fabrication, as well as complete tables of specifications and dimensions.

If you use or expect to use pipe fittings for welding, you need this book. Write for it today . . . Bulletin WT31.

BONNEY FORGE & TOOL WORKS, ALLENTOWN, PA.

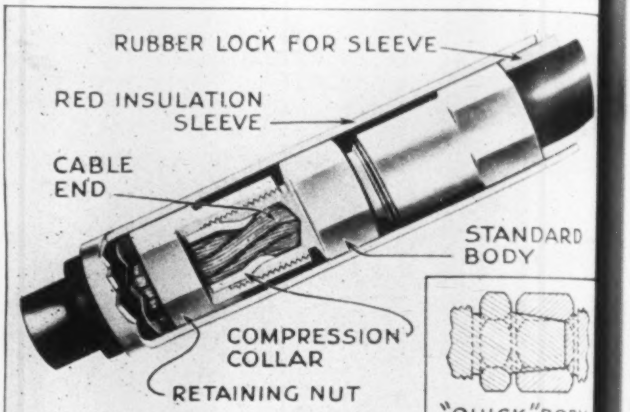
WELDOLETS·
TRADE MARKS - REG. U. S. PAT. OFF.
THREDOLETS

into extremely fine particles to produce a fog whic it is said, is particularly effective in fighting fires i volving highly volatile and inflammable material. The nozzles increase the exposed surface area of a give volume of water.

The fog laying nozzle was designed for use in pi lines and sprinkler systems and comes in various si capable of blanketing areas from 12 to 20 ft in d ameter, depending upon the pressure and size of nozzl The fog throwing nozzle fits any 1½ in. male standar thread hose connection and at 100 psi pressure is ca pable of projecting a mist of uniform distribution t distances of 40 to 50 ft.—Spraying Systems Co., 40 W. Lake St., Chicago, Ill.

Solderless Connectors for Welding Cables

No. 2391—Ease and speed of installation, safe protection of cables, and conservation of vital materia are among the advantages of the new "Cable-Tite" con nectors and lugs for welding cables, according to th manufacturer. The "quick" model, recommended f use where the whip end and main cables connect, has two piece body and a slight twist while connectin locks the body into one unit.



These connectors and lugs are available in a complet range of sizes. — National Cylinder Gas Co., 207 W Wacker Dr., Chicago, Ill.

Coolant and Circulating Pumps

No. 2392 — A new line of coolant and circulatin pumps includes ¾ and 1 in. sidewall mounted types, 1¼ in. sidewall mounted type for low submergen applications, and a 1¼ in. horizontal type.

These pumps are particularly suitable, says th maker, for installation on machinery requiring coolant or circulating unit; for example, those types o lathes, drills, automatics, cutoff machines, and grinder which require a constant supply of cooling fluid o cutting oil. Other equipment for which these pump are suitable includes evaporative condensers, air co ditioning units, washers, etc.—Ingersoll-Rand Co., 1 Broadway, New York, N. Y.

Down Blow Unit Heater

No. 2393—The down blow principle is incorporat in the new "Grid" unit heater, whose heating section are made of high test cast iron to cooperate with th war effort.

Special features include protection of the motor from the radiant heat of the unit itself, thereby preventing burning out of the motor, says the maker, who states that no electrolysis to cause corrosion can be developed, as each "fin" heating section is high test iron, cast in one piece, so that only one type metal comes into contact with steam or hot water.—D. J. Murray Mfg. Co., Wausau, Wis.

Blackout Heater and Ventilator

No. 2394—The "Vertivent" heater and ventilator has been designed and developed to meet requirements for installation in war production plants. These plants, covering large areas under one roof and designed for complete blackout without interrupting production, require a mechanical method of controlled ventilation and air tempering. This new unit can be automatically regulated to meet hour to hour requirements.

Consisting of a ventilator type air intake section mounted on the roof, and an air tempering section with coils, fan, and power unit enclosed in a housing suspended in the building, this unit takes air from outdoors, draws it through dual heating coils, and distributes it uniformly.

These units are available in capacities of 5000, 10,000 and 15,000 cfm.—Young Radiator Company, 709 Marquette St., Racine, Wis.

Stratosphere Testing Chambers

No. 2395—Stratosphere fighter planes battling eight miles above the earth may soon become a reality through the aid of giant steel "sky chambers" which are now making it possible for the first time to study the effects of super-altitudes on men and materials, it was reported last month.

In an address before the annual meeting of the American Society of Refrigerating Engineers, J. G. Bergdoll, Jr., chief engineer for the York Ice Machinery Corp., disclosed that the steel strato-chambers are enabling our armed forces to simulate stratosphere temperatures and pressures which hitherto have been found only in actual flight.

Describing the effects of the stratosphere on flight crews and plane parts, Mr. Bergdoll said the test chambers demonstrated that at certain altitudes rubber becomes as brittle as glass and that pilots when subjected to rapid increase in altitude, become victims of aeroembolism, the same ailment which deep sea divers call the bends. About 42,000 ft is the ceiling above which humans cannot go, he added, without pressurized suits or sealed cabins.

The dangerous obstacles which have made flying at altitudes as high as 40,000 ft impractical are now being studied and gradually eliminated in the test chambers and "it is not impossible that air battles will be fought eight miles above the ground," Mr. Bergdoll pointed out.

"Tests in the strato-chambers demonstrated the loss of physical and mental efficiency of the flight crews unless they were fed oxygen above about 15,000 ft altitude, disclosed that sleep or unconsciousness occurred at about 20,000 ft and that death from anoxemia or oxygen shortage occurred above this altitude if oxygen masks were not used," Mr. Bergdoll explained.

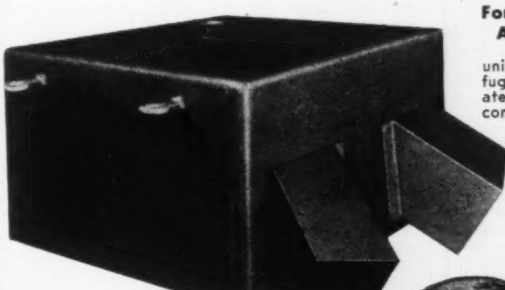
The chambers make it possible to simulate the effects

How to provide heat when-

1. Boilers are inadequate or overloaded
2. Overtime heat is needed with boilers shut down
3. Quick installation is essential
4. Rooms to be heated are beyond piping range

use

CHROMALOX Electric AIR HEATERS



For Large AREAS the type CUB unit heater, centrifugal blower operated. Thermostatic control. 15 to 40 kw.

For OFFICES and smaller areas. Type UB, has attractive crackle finish, and adjustable louvers directing blower-driven air. Heating unit can be disconnected for summer cooling. Eight sizes to 15 kw. →

← **For INDIVIDUAL ROOMS** Type HF, new streamlined design, attractive finish. Fan can be operated with or without heater. Four sizes—1½ to 4 kw.

- These heaters eliminate all the troubles that go with piped heat.
- To install them anywhere is only a quick and simple wiring job.
- They give *instant* heat, *any* time. They cut out boiler room costs for overtime work.
- They *circulate* refreshing warmed air.
- Their operation is not expensive. Check with us on this, or with your power company.
- Their continued service is assured, by their sturdy Chromalox heating units, well known for industrial heat in all applications.

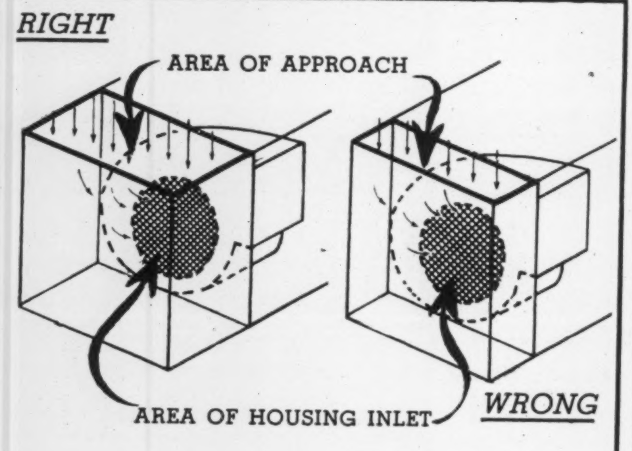
Tell us about your heating problem. Write for the Chromalox Catalog of Electric Heat.

EDWIN L. WIEGAND CO.
7610 Thomas Blvd. • Pittsburgh, Pa.

CHROMALOX
Electric Heat for Industry

TIPS FOR DESIGNING PRODUCTS USING AIR IMPELLERS

No. 1 of a Series



THE AIRSTREAM'S "AREA OF APPROACH" SHOULD BE AT LEAST 1½ TIMES AREA OF HOUSING INLET

Restrictions that prevent the unlimited flow of air into the blower wheel housing inlet should be avoided.

Where units require enclosure of the housing, or in cases where there are necessary obstructions to the air stream at any point in its approach to the inlet, the "area of approach" (the area of the cross section of the air stream) should be at least 1½ times the area of the housing inlet (see diagram above). If this ratio is less, "starving" of the blower wheel will result.

This important rule of design is but one of a number which affect performance of a blower wheel and hence of a product in which the wheel's function is important.

By consulting the Torrington Research Laboratory, preferably during the early stages of design of products using air impellers, engineers may save costly changes and delays. This free consulting service incurs no obligation.

THE TORRINGTON MANUFACTURING CO., TORRINGTON, CONN.

MANUFACTURERS OF AIRISTOCRAT QUIET PROPELLER FAN BLADES AND AIROTOR BLOWER WHEELS

of a dive bomber tearing to earth at a speed of 1000 fps, the engineer said. In one chamber, used for diving and climbing tests, the atmospheric pressure inside must change from that found at sea level, about 15 psi, to less than 2 psi encountered at about nine miles above the earth. This, plus a drop in temperature from 70 deg above to 67 deg below zero is accomplished in 12 min.

The strato-chambers are steel cylinders approximately 22 ft long, resembling in appearance the complicated interior of a submarine. The interior is divided into two chambers separated by an airtight steel door. Major equipment includes refrigerating compressors which regulate the temperatures in the shell from subzero to normal, and several vacuum pumps required to reduce the air pressure to stratospheric conditions.

Space for six men in flying clothes is provided in the inner chamber or "climb chamber," Mr. Bergdoll explained. After the test subjects have been seated, the vacuum pumps and fans are started and the dampers admitting cold air to the climb chamber are opened. A sufficient reservoir of refrigeration is built up to reduce the temperature within the climb chamber to 70 deg below zero in 12 min. Oxygen masks supplied from the outside and electrically heated suits protect the subjects.

The engineer explained that these strato-chambers are being used by the Army, Navy, and private concerns to test gas line, rubber, metal parts and nearly every item which goes into a plane, for their endurance in the frigid stratosphere weather.—York Ice Machinery Corp., Roosevelt Ave., York, Pa.

Steel Scaffolding

No. 2396—A new time saving assembly method has been designed in cooperation with Goodyear Tire & Rubber Co.

The basic unit of this steel scaffolding system consists of two end frames which, when erected, are held rigidly together by two cross braces. This forms a complete unit 5 ft wide, 7 ft long and 5 ft high. Desired heights are obtained by adding similar units to the basic unit through the use of coupling pins. Additional lengths are made by adding frames and fastening them together with cross braces.

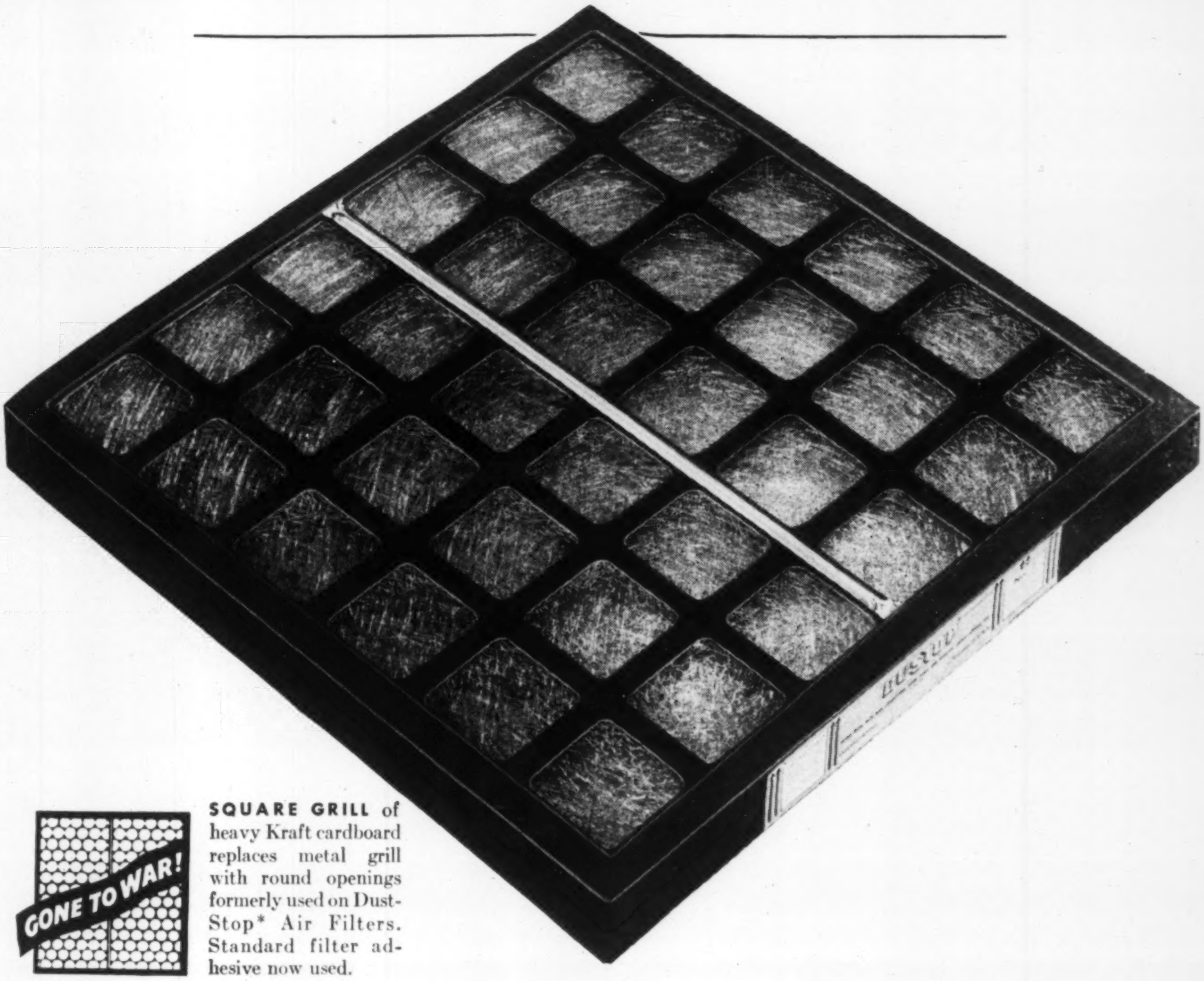
For new plant building, or old plant modernization and maintenance work, the method meets the demands for speedy erection, flexibility of installation, and safety of workmen, says the manufacturer. Two men can erect 30 vertical ft in 30 min; the unit members are assembled on the job to fit any height, shape or size, and the complete system may be stationary or portable as required.—Safway Steel Products, Inc., 6228 W. State St., Milwaukee, Wis.

WPB Order on Industrial Controls

Industrial thermometers, pressure gages, control valves, and other industrial type instruments were placed under the control of the War Production Board by the director general for operations last month.

The control established by limitation order L-234 requires manufacturers of such instruments to file

HERE IS DUST-STOP'S NEW "WAR" FILTER!



SQUARE GRILL of heavy Kraft cardboard replaces metal grill with round openings formerly used on Dust-Stop* Air Filters. Standard filter adhesive now used.

1. **Quickly available**
2. **Price and maintenance economy the same**
3. **Filtering efficiency maintained**
4. **Saves critical metals and materials**

BOMBER and tank plants, instrument manufacturers, scores of other war industries are using Dust-Stops in such great quantities that more of these filters were sold in 1942 than in any other year.

For dust control in precision manufacture means mechanical ventilation or air conditioning. And the makers of such equipment recognize the importance of Dust-Stops and include them in their systems.

Householders, too, have been using Dust-Stops in greater numbers than formerly. For clean filters help assure top efficiency from forced warm air furnaces—a big point with fuel rationing.

It was the responsibility of Dust-Stop engineers to meet this increased demand. They met it by designing a filter—the new "war" filter—which saves critical materials and keeps most of the advantages of the former Dust-Stop.

Most Advantages of the Leader in the Filter Field Remain Unchanged

Performance: Capacity, 2 CFM per sq. in. of area at 300 FPM. Average resistance, new, in inches of water gauge, .065 for 1-inch, .13 for 2-inch.

Economy: Cost only 1c per CFM as original equipment for industrial installations. Less than 1/10 of 1c per CFM to replace.

Maintenance: Filter face can be vacuum cleaned or rapped out, this practice can be repeated once or twice, further reducing maintenance costs.

Easy to Change: Anyone can replace dirty filters with new Dust-Stops in a jiffy.

Availability: Made from all-American materials which are not now listed as critical. Production is being expanded to meet growing requirements.

What about Fire-safety? The famous non-inflammable Dust-Stop adhesive is no longer available. As a substitute, standard filter adhesive are now used. The filter media is still made of incombustible glass fibers.

Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

ARMY E NAVY

FIBERGLAS* DUSTOP* AIR FILTERS

*T.M. Reg. U.S. Pat. Off.

monthly reports, showing their productive capacity, requested future deliveries, and previous month's production. The order also provides that the director general may issue directions to any manufacturer regarding the scheduling of his production and deliveries. Until such directions are issued, the manufacturer will continue to schedule his production and deliveries in accordance with general priorities regulations and any specific directions which he may have received.

An "industrial type instrument" is defined as any new mechanism of the kinds or types named on list A issued with the present order, or as it may be amended from time to time, whether or not such instrument be used in an industrial process.

Second Edition of Text on Heat

Heat, by James M. Cork, professor of physics at the University of Michigan, is a book intended primarily as a text for college study. Nevertheless it contains a world of material which should be of value to anyone who deals daily with heat engineering. The reading of this book will not only provide a sound background, but will provide much interesting material on modern theories of heat and on experimental methods used to derive the basic values used in the daily work of engineers. The book should be of considerable value to engineeers for reference purposes.

Chapters of special interest to engineers are those on temperature and its measurement, specific heats, thermal expansion, transfer of heat, radiation, and the state of matter. There are also chapters on elementary thermodynamics and on the production of high and low temperatures. In particular, the chapters on temperature and its measurement and on radiation will prove interesting reading.

The book is clearly written. However, although much of the book is readable and requires no knowledge of mathematics for its understanding, there are still many sections where a good knowledge of mathematics is required to follow the material.

The publisher is John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price of this 307 p. second edition is $3.50.

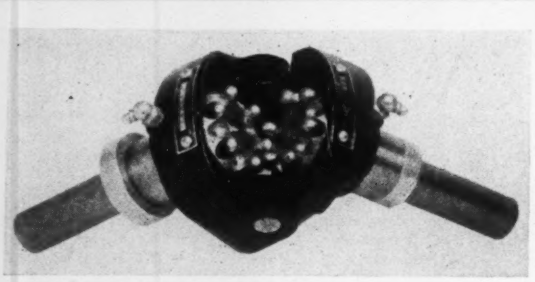
Hot Water Supply Boiler Standard

In accordance with action taken at a general conference on hot water supply boilers, TS-3405, held in Washington, December 4, 1942, a recommended commercial standard, TS-3406, is being circulated to producers, distributors, and users of these boilers for written acceptance as a basis for publication by the National Bureau of Standards.

The purpose of this standard is to provide a uniform method of testing and rating the performance of hand fired hot water supply boilers as a basis for fair competition among manufacturers, and to assure adequate capacity to the purchaser by means of guarantee labels.

The standard covers the testing and rating of hot water supply boilers fired with solid fuel which are designed to supply hot water to service water tanks, with ratings up to 450 gal, 100 F rise.

Remote Controls for Inaccessible Valves—



CONSOLIDATED HINGED JOINTS

Featuring alternate ball and socket gear design—lubrication direct to all points of contact—for smoother operation, reduced lag and longer service.

MADE EASY by the Use of Consolidated Hinged Joints

The design of the Consolidated Hinged Joints provides for positive and effective operating range from 0° to 92° in a given plane.

This joint is now replacing knuckle type universal joints and bevel and mitre gears. The narrow effective operating range of knuckle joints and the unyielding housings of bevel and mitre gears limits their use. Our engineers will be glad to survey your problems and furnish engineering data applicable to your special requirements.

Send for our new catalogue showing Consolidated Hinged Joints described above and Brooks Universal Joints with operating range from 0° to 360° in any plane along with our full line of Brackets, Expansion Couplings, Shaft Hangers, and Shaft Covers.

Send for
TECHNICAL DATA
BULLETINS

BROOKS EQUIPMENT CORPORATION
90 WEST STREET NEW YORK CITY

Trade Literature

r convenience in obtaining copies of these bulletins, on on page 173. If you write direct to the manufac- describe carefully what literature you want, as the given first in each item is for use only when send- our request to Heating, Piping & Air Conditioning.

elocity Meters

350—8 p. bulletin (2448E) on "Alnor Velome- irect reading air velocity meters, describing the ments, their scale ranges and accuracy, and giv- ailed information on use of the various types of r different kinds of readings. Prices are shown, large diagram indicates the many uses of the ments for velocity and pressure measurements of t systems. There are also photographs showing linois Testing Laboratories, Inc., 420 N. La t., Chicago, Ill.

rs

351—Instruction sheet for posting on the boiler ll giving information on the care and operation manufacturer's updraft firebox boilers, with sug- s for firing, general care, and care of the boiler summer.—Fitzgibbons Boiler Co., Inc., 101 Park ew York, N. Y.

g

352—Issue of Low Temperature Brazing News 0) showing several brazing applications of spe- erest to war production plants.—Handy & Har- Fulton St., New York, N. Y.

ols

353—16 p. specification data booklet for "A-H ectrical controls for heating and ventilating sys- iscussing types of ventilating and heating equip- nd showing and illustrating the various controls ith different heating and ventilating methods.— Hart & Hegeman Electric Co., 103 Hawthorn rtford, Conn.

ols for Fuel Conservation

354—16 p. bulletin on selecting controls for fuel ation, by M. W. Crew, including information on n of automatic controls and instruments for draft coal firing, stoker firing, natural draft oil , forced draft hand firing, and chain grate and r stokers. Use and value of combustion instru- s discussed and specimen control installations wn.—Hotstream Heater Co., 8007 Grand Ave., d, Ohio.

ings

355—Leaflet describing detachable couplings require no soldering or brazing, self-flaring s for copper tubing, and flexible hose and hose es.—Packless Metal Products Corp., 31 Win- ve., New Rochelle, N. Y.

THERM-O-TILE

REG. U. S. PAT. OFF.

A Complete Conduit System for the Permanent Support, Protection, and the Insulation of Underground Mains of

CENTRAL HEATING SYSTEMS

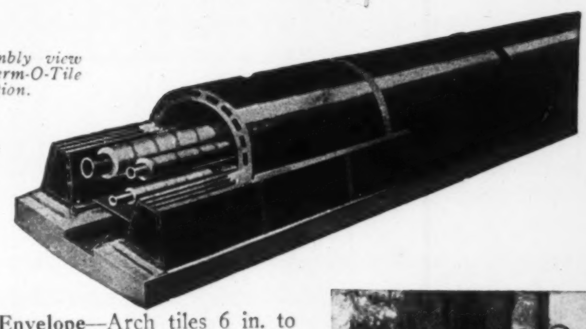


Fig. 1—Assembly view of typical Therm-O-Tile Installation.

Tile Envelope—Arch tiles 6 in. to 24 in. in diam. With 5 different size base tiles they produce 27 different conduit cross sections.

Foundation—Base is a thick concrete slab poured directly in the trench bottom, steel reinforced when installed over filled or boggy ground. Figs. 1, 4, 6 and 7.

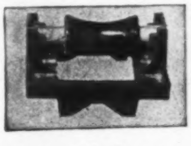


Fig. 2—Pipe Support for Single Pipe.

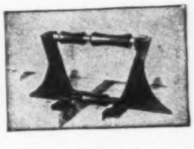


Fig. 3—Pipe Support for Three Pipes.

Drainage—Drainage is entirely internal, accurately and permanently sloped. Condensate pockets cannot form. Open to inspection at manholes. Of ample capacity to keep pipe space dry at all times. No possibility of clogging with silt or vegetation. Figs. 6 and 7.

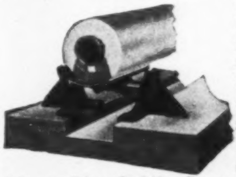


Fig. 4—Pipe Saddle. Permits full thickness of insulation between pipe and roller.

Pipe Support—All pipes rest on cast-iron adjustable supports directly on base independent of tile envelope. Figs. 2, 3, 4, 6 and 7.

Accessibility—All piping is installed before tile is placed, giving complete accessibility for welding, testing and insulation. No interference of tile or other trades working in trench at same time. Pipe fitters work on convenient concrete slab "walkway" Figs. 1 and 4.

Strength—Due to immovable concrete base and arch of extra heavy tile greater loads can be carried on top of conduit without extra reinforcement.

Metal Saving—Pipe supports and saddles are the only metal used in Therm-O-Tile. Practically 100 per cent non-metallic.

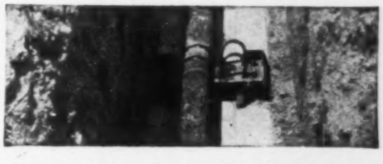


Fig. 5—Anchor Block. Fits directly in line with Base Tiles.

Insulation—Either sectional pipe covering or Thermobestos waterproof fibre filling may be used for insulation. For single or double pipe lines, sectional insulation is recommended; for multiple pipe lines, a filler type of insulation is usually more economical. Figs. 6 and 7.

Waterproofing—Under normal soil conditions, this conduit is waterproof. If marshy or extremely wet, conduit may be completely waterproofed by use of membrane waterproofing applied under slab on sub-base and carried completely over tile envelope.

Efficiency—Thermal efficiency depends largely upon type and thickness of insulation used. Due to sealed air chambers in Therm-O-Tile and dry insulation space, normal efficiency of insulating material on pipe lines is increased.

Miscellaneous—Quicker installation. More easily repaired. Cave-ins and storms cause less damage and expense. Ask for Bulletin 381.

Representatives — Therm-O-Tile is sold and installed by Johns-Manville Construction Units in all principal cities.

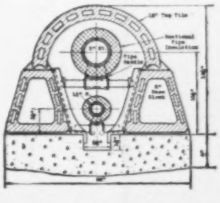


Fig. 6—Single or Double Pipe Lines Using Sectional Pipe Insulation.

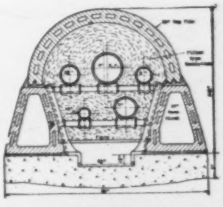


Fig. 7—Multiple Pipe Lines Using Filler Type Insulation.

H. W. PORTER & CO., INC.

Victory Metal
One medium Tank requires almost one-half ton of copper
HUSSEY COPPER
GOES WHERE
VITALLY NEEDED TODAY!

Ounces of copper, here—pounds of copper, there . . . every application vital to total tank performance!

Copper is fundamentally required in thousands of certain special war uses. Uniform and easily workable HUSSEY COPPER is a "front line" menace to the enemy and truly lives up to its reputation as a Victory Metal.

HUSSEY

C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
Rolling Mills and General Offices: Pittsburgh, Pa.
Warehouses in Principal Cities

Feedwater Conditioning

No. 4356—8 p. reprint on conditioning feedwater for high pressure boilers, by Austin C. Dresher, which sums up requirements and discusses importance of scale removal, corrosion, carryover, and embrittlement. The different methods employed in feedwater conditioning are discussed.—Cochrane Corp., 3131 N. 17th St., Philadelphia, Pa.

Hard Surfacing

No. 4357—2 p. mimeographed bulletin (185) on hard surfacing of worn parts, listing the metals to which the method can be applied, physical properties, advantages, procedure, etc.—Eutectic Welding Alloys Co., 40 Worth St., New York, N. Y.

How to Salvage Tools

No. 4358—Instruction sheet, for posting in the shop, giving procedure for salvaging various types of tools by means of low temperature welding.—Eutectic Welding Alloys Co., 40 Worth St., New York, N. Y.

Laboratory Equipment

No. 4359—12 p. bulletin (498) on laboratory equipment, including sinks, pipe and pipe fittings, and ventilating equipment.—U. S. Stoneware Co., 60 E. 42nd St., New York, N. Y.

Lubrication

No. 4360—Issue of Lubrication (Vol. 28, No. 10) covering lubrication of industrial coal burning equipment and giving detailed information on stokers, bearings, and their requirements.—The Texas Co., 135 E. 42nd St., New York, N. Y.

Molybdenum

No. 4361—Series of data sheets representing a revised version of section 2 of the publication Molybdenum in Steel. A large amount of technical information on the subject is included.—Climax Molybdenum Co., 500 Fifth Ave., New York, N. Y.

Relays

No. 4362—1 p. bulletin (104) on midget metal base relays, and 1 p. bulletin (23) on strip resistors.—Ward Leonard Electric Co., 37 South St., Mt. Vernon, N. Y.

Standard Steel Shapes

No. 4363—24 p. bulletin on standard steel shapes which can be purchased as production items, without die or tool charges. Specifications and drawings for each of the shapes are attractively presented.—Commercial Shearing and Stamping Co., 1775 Logan, Youngstown, Ohio.

Unit Coolers

No. 4364—Specification sheets on "cold diffuser" unit coolers especially suited for use in wholesale food storage and each giving descriptions, specifications, dimensions, and drawings.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Welding

No. 4365—12 p. booklet (B-3136) describing "Flexarc" a-c welders and comparing advantages of a-c and d-c welding.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Useful Information

New Methods in Exhaust Ventilation

Following is an abstract of a progress report on a study supported by the Industrial Hygiene Foundation on New Methods in Exhaust Ventilation, by T. F. Hatch and Robert H. Walpole, Jr., department of public health and preventive medicine, University of Pennsylvania, presented by Prof. Hatch at the seventh annual meeting of the foundation:

1) *Objective of study*—The objective of this study was to develop, so far as possible, a fundamental basis for determining the design requirements of exhaust systems which would serve in place of the empirical procedures now commonly employed.

2) *Factual basis for a fundamental method of hood design.*

a) All atmospheric contaminants released by industrial processes are dispersed into the plant atmosphere by air movement only. If there were no air motion past the offending process there would be no distribution of the contaminant beyond the immediate zone of release.

b) The function of an exhaust hood, therefore, is not to capture the contaminant but to collect the air into which the contaminant is dispersed.

c) The rate of air flow into an exhaust hood, as a consequence, must equal or exceed the rate of flow of air past the process.

d) The extent to which the hood ventilating rate must exceed the rate of air movement depends upon the hood efficiency; that is, upon the amount of clean air which must be exhausted in order to capture all of the contaminated air.

3) *Measurement of rate of air displacement as a basis for hood design.*

a) Since it is the air movement away from the zone of contaminant release which the exhaust hood must prevent, it is clear that one should know the rate at which air is flowing through the area in order to determine the minimum rate of exhaust ventilation required.

b) The primary recommendation resulting from this investigation, therefore, is that, preliminary to the design of an air exhaust system, the rates of air displacement existing at the various processes be measured.

c) Rates thus obtained will serve, with suitable factors of safety, to determine the air flow capacity of the exhaust system.

d) This procedure contemplates the direct study of the actual processes to be controlled and does not depend upon assumed similarity with other processes and experience with them.

RUSH ORDER...
FOR A TOUGH CUSTOMER
WHO ASKED FOR IT!

EVERY American-made shell stabbing through today's Axis landscape carries a promise . . . of plenty more coming . . . from an America now producing more than the enemy ever bargained for.

The thunder of our guns, daily more deafening to Berlin and Tokyo, voices the war-time industrial might of our factories and shipyards—turning mountains of raw materials into an endless and overwhelming flood of shells . . . ships . . . torpedoes . . . tanks . . . planes. In plants of all types throughout America, Todd Combustion Equipment is contributing to efficient, trouble-free power-production . . . maintaining unsurpassed standards in the combustion of liquid and gaseous fuels.

With over 50 thousand units now in active industrial and commercial service, Todd technical staffs . . . with parts and replacements instantly available in key cities . . . are co-operating with plant engineers responsible for uninterrupted firing on the vital power-production front.

TODD COMBUSTION EQUIPMENT, INC.

(Division of Todd Shipyards Corporation)

601 West 26th Street, New York City

New York Mobile New Orleans Galveston

Carey HEAT INSULATIONS AIDING FUEL CONSERVATION IN IMPORTANT PUBLIC CONSTRUCTION

Insulation Contractor: T. G. Egan, Refractory Engineering Co., Brooklyn, N. Y.

The new Post Office at Charleston, W. Va., is representative of the many public buildings throughout the nation in which CAREY Insulations are used to conserve the vital national resource—FUEL.

Carey Insulations, by their high resistance to the passage of heat and their exceptional impact strength, offer top efficiency combined with permanence—an essential factor in fuel conservation that quickly returns its cost in savings, usually in a year or less.

Through constant scientific research, Carey Insulations have kept pace with heating progress—met every new demand—every service requirement. Over a half century of manufacturing experience and a nationwide engineering and service organization are back of their outstanding performance.

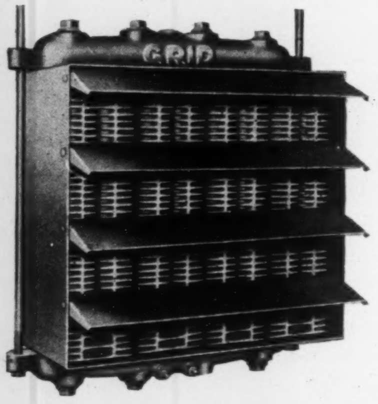
Whatever your insulation needs, specify CAREY for maximum economy and lasting satisfaction. For details, address Dept. 25.

THE PHILIP CAREY MFG. COMPANY

DEPENDABLE PRODUCTS SINCE 1873

LOCKLAND, CINCINNATI, OHIO

IN CANADA: THE PHILIP CAREY COMPANY, LTD
OFFICE AND FACTORY
LENNOXVILLE, P.Q



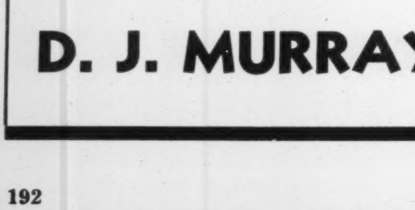
THE "GRID" IS STILL A DIFFERENT UNIT HEATER

Now made of high test cast iron instead of aluminum heating sections, to cooperate with the war effort in conservation of vital materials. Patent applied for.

Designed and tested to operate with steam or hot water systems—for steam pressures from 2 lbs. to 250 lbs. Engineered along the same lines as the standard GRID Unit which had aluminum heating sections and has been on the market since 1929.

NO ELECTROLYSIS TO CAUSE CORROSION

Low maintenance expense.	Lower outlet temperature.
More air changes per hour.	Larger air volume.
Positive "directed" heat.	No soldered, brazed or expanded joints.
No leaks—no breakdowns.	Open design that keeps units clean.



CI (CAST IRON) SERIES GRID UNIT HEATER DATA

Model No.	Dimensions					Motor		Vol. Fan	Capacities 5 lb. Steam 60° Air		Approx. Shipping Weight	Pipe Sizes	
	A	B	C	D	E	Hp	Rpm		Btu/Hr	Final TMP		Supply	Ret.
CI 1500	17½	15⅜	11½	16	23⅜	1/10	1750	1500	76500	107	275	1½"	1¼"
CI 2000	22⅛	21⅝	11⅞	21¼	28⅜	1/6	1150	2600	143000	110	440	2"	1¼"
CI 2504	27½	26	13	26	35¼	1/4	1150	3300	206000	117	660	*2"	1¼"
CI 2500	27½	26	13	26	35¼	1/2	1150	4350	224000	107	675	*2"	1¼"
CI 3000	32⅝	31⅛	13	31⅛	39⅛	1/2	850	6300	332000	108	1050	*2½"	1¼"
CI 3000	32⅝	31⅛	13	31⅛	39⅛	1½	1150	8000	380000	103	1050	*2½"	1¼"

*Furnished also with 2 in. top supply connection inlet.

Send for complete catalog information

D. J. MURRAY MFG. CO., Wausau, Wisconsin

Offices in Principal Cities

e) The proposed method does not have universal application since it requires that the pattern of air flow past the process be rather clearly defined. It also requires a certain degree of enclosure of the process. Its application is believed to be wide, however, and experience with it in the design of a large scale system has demonstrated its practical value.

4) *Method of measuring rate of air displacement.*

a) Air motion around an industrial process may result from a number of causes which may be divided, according to source, into two classes: external and internal. Examples of the former are: normal room convection currents, action of nearby belts, flywheels, movement of reciprocating parts. Internal sources include those which are inherent in the process and others which are only incidental. Inherent sources include the strong convection currents set up by hot bodies (such as a casting, steam bath, welding operations), by the expansion and contraction of a stream of falling rock as it leaves a belt and falls into a bin, the fan action of a grinding wheel or of a hammer mill, etc.

b) The air flow established by such sources is not confined to a definite path and cannot, therefore, be measured by the usual methods of metering. In the present study use was made of the well-known technic of measuring the dilution of a suitable test substance, in this case a test gas introduced into the air stream. The method has been described and its errors and limitations discussed in a recent foundation bulletin. In its present form it is relatively simple to use but has the serious disadvantage of not yielding instantaneous concentrations which must be known in many cases where the rate of air displacement is not continuous but rises periodically from zero or a low level to a maximum value and then back again (example: barrel filling). In place of the chemical method of analysis for the determination of the test gas concentration, a direct reading meter should be used. No such instrument is now available for carbon dioxide. In certain studies toluene has been employed as the test gas since it can be measured instantaneously in a direct reading photometer. For obvious reasons, solvent vapors could not be employed in industrial plants. Recent developments in the use of infrared photometry for measuring carbon dioxide are promising. Another possibility is to employ a test gas containing a radio active substance, the concentration of which could be simply measured. These and other suggestions should be investigated further since the basic idea of determining ventilation requirements from measurement of the rate of air displacement appears to have considerable practical value.

5) *Suggested steps in hood design.*

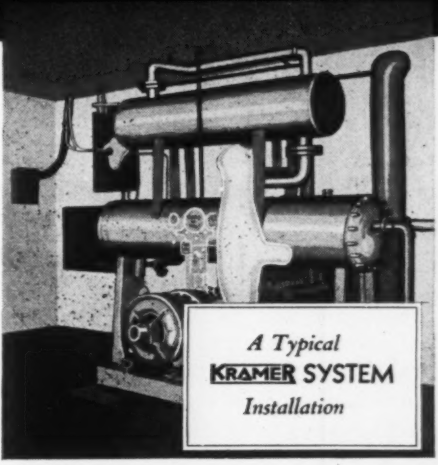
a) Study the process with a view to determining the source or sources of air motion which is established during its operation.

b) If a source is external and independent of the process take every practical means to eliminate it. For example, a flywheel or other rotating part may be shielded; convection currents rising from a hot tank can be minimized by insulating the side walls; leaking parts in a compressed air operated machine should be repaired.

c) Even a source of air movement which is inherent

KRAMER
Balance Loader
SYSTEM

The Greatest Achievement
IN REFRIGERATION CONTROL
SINCE THE INTRODUCTION OF
THE THERMOSTATIC
EXPANSION VALVE



A Typical
KRAMER SYSTEM
Installation

The KRAMER Balance Loader SYSTEM (Patented) is a modulating refrigeration system capable of varying from 0% to 100% of full load, and maintaining a fixed minimum back pressure in the suction line and in the compressor crank case.

The KRAMER SYSTEM will automatically compensate for varying evaporator loads, resulting in an infinite number of compressor capacity points, giving straight line capacity modulation.

The KRAMER SYSTEM is the only one that will give a full range of modulation at a fixed minimum back pressure throughout the entire low side.

The KRAMER SYSTEM can be applied to new or existing refrigeration installations

Send for Catalog BL-342

KRAMER TRENTON Co.
MANUFACTURERS OF
Heat Transfer Products
TRENTON, N. J.

BUSINESS AS USUAL?
Certainly...

Most of your business has been classified as "essential civilian needs." Which means just that. Civilians really NEED cooling equipment . . . to keep buying bonds . . . to keep producing food and munitions . . . to help win the war. We believe that this places a very definite obligation upon us . . . upon you to continue to sell essential cooling equipment . . . and upon this company to continue to produce it.

In addition to serving essential civilian needs, Bush products are in use by the Army, Navy, Air Force and Merchant Marine to meet literally hundreds of cooling and air conditioning requirements.

Bush
Mfg. Co.

★ *Commercial Cooling Units* ★

HARTFORD, CONN. • 415 LEXINGTON AVE., NEW YORK
549 W. WASHINGTON BLVD., CHICAGO

NEVER BEFORE HAS "BEING GOOD" BEEN SO IMPORTANT

ASK any man who knows refrigeration equipment and chances are he'll tell you, "Yes, BAKER machines are good."

There's a lot behind those 5 simple words, uttered voluntarily. There's meaning, and belief, and conviction that BAKER machines are good.

And we believe that 38 years of supplying satisfied users is pretty powerful proof.

Right now, BAKER is in the middle of a double-barreled program with two big objectives:

1. Build precision parts for the machines of war. Build into them the same accuracy, dependability, rugged endurance that is a byword of other BAKER-built equipment.
2. Build dependable refrigerating equipment for all air-conditioning and refrigeration applications.

With refrigeration on the home front and on distant foreign fronts playing a vital role in the war program, we think it mighty important that the equipment used can be honestly appraised by those who know as—
"Good!"

•

BAKER

ICE MACHINE COMPANY, INC.
1508 Evans St., Omaha, Nebr.

AUTHORITY ON MECHANICAL
COOLING FOR 38 YEARS

BUY U. S. WAR BONDS AND
STAMPS

in a process may be reduced in strength. For example, the amount of air displaced by falling rock increases with the height of fall. By substituting a stone ladder for an uninterrupted chute the total drop is broken into several steps which together will produce less air displacement.

d) In the case of semi-enclosed processes, determine the points of entrance of the air as well as the escape openings. In many cases the opportunity for air to get in can be greatly reduced, thus minimizing the rate of displacement. For example, the airflow resulting from the strong fan action of a hammer mill can be reduced by carefully restricting the inlet.

e) After identifying the sources of air displacement and eliminating or minimizing all that are subject to control, the next step is to study the pattern of air flow. For this purpose a visual smoke generator may be employed.

f) Next, construct a temporary enclosure (if one is necessary) of a pattern that will confine the flow in the manner desired.

g) Using the temporary enclosure, measure the rate of air flow by the dilution technic.

h) From the rate of air displacement thus determined and the knowledge of air flow pattern obtained by smoke tests, an estimate may be made of the factor of safety to be employed. Thus, the rate of ventilation is determined.

6) The time required to make the tests outlined above is not great and it is believed that the information thus obtained will result, in many instances, in improved design and performance of exhaust systems.

7) *Application to the study of general ventilation.*

a) For the control of a number of industrial operations, general room ventilation is employed. The rate of ventilation should be determined so as to dilute the contaminant down to a safe level. By means of the dilution technic the ventilation characteristics of the room may be evaluated and a quantitative basis for improving the system of general ventilation obtained. The steps are as follows:

Feed the test gas at a constant rate into the zone of release of the contaminant.

Determine the equilibrium concentrations of the test gas at the various working locations and in the air as finally discharged from the room.

Under conditions of complete mixing the concentrations thus obtained would be alike. If, at any sampling point, the concentration is higher than at the final outlet, one knows that the rate of effective ventilation in this area is less than for the room as a whole and in reverse proportions to the concentration found.

From such a survey it will be possible to improve the system so as to effect more uniform ventilation and, perhaps, without any actual increase in the total ventilation.

If, in addition to the equilibrium concentrations, the rates of buildup of the test gas concentrations and the rate of decay after the gas feed is shut off are obtained, one can predict the cycle of concentrations of the contaminant which will obtain at the various points of exposure for a given cyclical release of the contaminant. The mathematical relationships will be considered in another report.

Newest!

Specification Data
A-H&H
ELECTRICAL CONTROLS
for
Heating and
Ventilating Systems
Use with Complete Motor Controls Catalog No. 9
THE ARROW-HART & HEGEMAN ELECTRIC CO.
HARTFORD, CONNECTICUT, U.S.A.

ELECTRICAL
SPECIFICATION DATA

— *for* the heating and ventilation Engineer. Up-to-the-minute information on what to specify for convenient, dependable control. Simplified arrangement of recommended Electrical Controls for each type of equipment in *your specialized field.* Will help you to get what you need now — *need urgently* — for eligible jobs. Use Coupon, save writing.

INDUSTRIAL CONTROL DIVISION,
ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN.

To Industrial Control Division, Arrow-Hart & Hegeman Electric Company, Hartford, Conn.

Send your new ELECTRICAL CONTROLS Data Book to

(*Name*)____________________
(*Company*)____________________
(*Address*)____________________
(*City & State*)____________________
PA

8) *Acknowledgments.*

Grateful acknowledgment is made to the Industrial Hygiene Foundation and to the American Air Filter Co. for their financial assistance which made this study possible. It is regretted that, because of the war, the work had to stop while still in the preliminary stage. A full report will be made of the work and especially of the application of the proposed technic in the design of a large exhaust system. It is to be hoped that the method will receive further field tests and that a simpler and more flexible test procedure will be developed.

Gas Air Conditioning

The 1942 report of the American Gas Association's joint committee on gas summer air conditioning, of which L. Ourusoff, Washington Gas Light Co., is chairman, indicates that gas air conditioning "attained acceptance in 1942 and stands ready to expand."

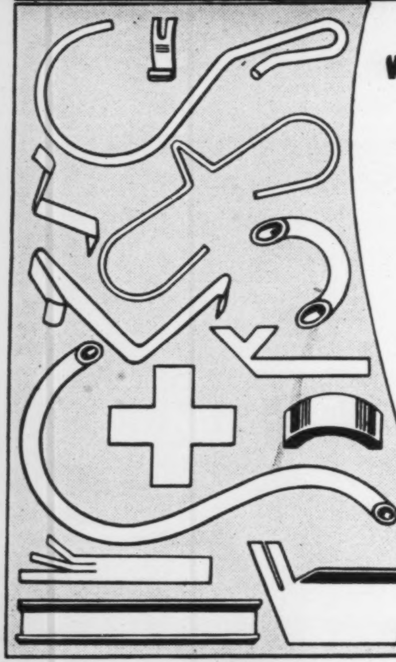
According to the committee, many vital applications to the war effort were made in 1942 and the acceptance of gas dehydration in the industrial field is now definite and appears to be permanent. Several successful commercial installations were made and the committee believes that expansion in that field is promising for natural gas territory.

The committee recommended that its 1943 activities be centered principally on continuation of development through: research and testing, collection and analysis of field data, and further studies of existing types of apparatus with the objective of obtaining a greater degree of equipment refinement, simplicity, and reliability.

In a subcommittee report, a number of examples of war uses of gas dehumidification equipment were given, as follows:

> There are a score or more of arsenals in various parts of the country producing black powder. This powder must be dried to an exact moisture content and must be handled at comparatively low temperature to prevent explosion hazards. On a typical summer day it formerly required up to 15 hr. to dry a batch of black powder. Now, heat activated dehydration equipment is doing the same job in 3 hr. Production schedules can thus be carried through with a fixed drying time. Practically every pound of black powder produced is dried by this method.
>
> Moreover, practically every square foot of bulletproof and safety glass produced in this country has the aid of heat activated dehydrators in its production. The rooms in which the plastic binder is handled must be kept at extremely low dew points and at comparatively low temperatures. This is accomplished by the use of combination dehydration and refrigeration equipment. This plastic bonded laminated glass is used on airplanes, jeeps, scout cars, and numerous other vehicles.
>
> America's largest manufacturer of altimeters for aircraft is a longtime user of gas fired dehydrators. The maintenance of low humidities in the assembly and inspection departments is an essential to prevent sweating hands from itching, tarnishing, or rusting highly polished metal surfaces. Furthermore, even a minute amount of water vapor trapped in the instrument on a humid day would precipitate and freeze when the instrument is tested at the specified temperature of 67 deg below zero, a condition which instruments may meet in use. Low humidity assembly rooms prevent this. Numerous other manufacturers of precision instruments and optical devices have found similar benefits from the direct control of humidity by means of gas fired dehydrators.
>
> A number of dehumidifier installations in storage rooms prevent corrosion of highly finished machine parts. A typ-

DIE-LESS DUPLICATING



with "DI-ACRO" Precision Machines

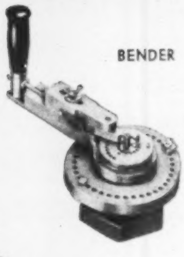
The parts shown are typical of the great variety of simple or intricate forms and shapes which can be quickly duplicated to a tolerance of .001" with DI-ACRO Precision Machines — Shears, Brakes, Benders. For experimental and research work or production runs, DI-ACRO Units form angle, channel, tube, rod, moulding, wire, strip stock; shear stock sheets, trim duplicated stampings. With **DIE-LESS DUPLICATING**, Man Hours and Critical Materials are frequently saved.

WRITE FOR CATALOG

Send today for new 32-page catalog —"Metal Duplicating Without Dies" giving full information on the capacity of DI-ACRO Shears, Brakes, and Benders and illustrating their great variety of applications.

BENDER

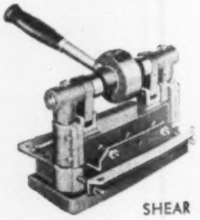
DI-ACRO Bender bends angle, channel, rod, tubing, wire, moulding, strip stock, etc. Capacity — Bender No. 1,—¼" round cold rolled steel bar. Bender No. 2,—½" cold rolled steel bar.



BENDER

SHEAR

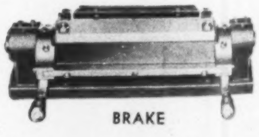
DI-ACRO Shear squares and sizes materials, cuts strips, makes slits or notches, trims duplicated stampings. Shearing width —Shear No. 1,—6". Shear No. 2,—9". Shear No. 3, —12".



SHEAR

BRAKE

DI-ACRO Brake forms non-stock angles, channels or "Vees." Right or left hand operation. Folding width—Brake No. 1,—6". Brake No. 2, — 12". Brake No. 3,—18".



BRAKE

DI-ACRO PRECISION MACHINES

O'NEIL-IRWIN MFG. CO.

313 8th AVENUE SOUTH MINNEAPOLIS, MINNESOTA

FULL ACTIVE GRATE SURFACE

without dead plates

MORE grate area—with low combustion rate per square foot! . . . Frederick Stokers have fully active, self-contained burning ends, with specially designed, heavy-ribbed tuyeres, and with air ports so arranged and proportioned as to insure correct air distribution and maximum efficiency in combustion!

Just one of many new developments, Frederick engineered, this new burning end and other Frederick developments for increased stoker efficiency, convenience and economy are described fully in folder free upon request. Write for your copy—today.

FREDERICK INDUSTRIAL STOKERS

The FREDERICK IRON & STEEL CO.
East & Seventh Sts., Frederick, Maryland

Centrifugal Pumps for All Purposes

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

APPLY WITH BRUSH, TROWEL OR SPRAY

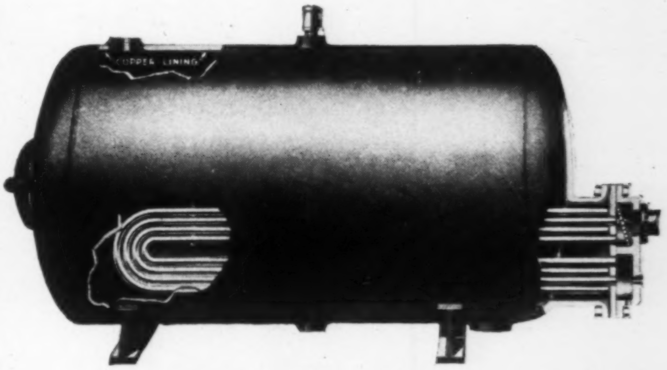
A SURE CURE

NoDrip ● This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance and can be painted any color. A gallon covers about 30 feet of 1" O.D. pipe. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House. Write for **NoDrip Handbook.**

J. W. MORTELL CO.
Technical Coatings Since 1895
512 Burch Street, Kankakee, Illinois



A GOOD INVESTMENT IN '39

a Prime Asset Today

Sounds unbelievable, but it wasn't so long ago that Patterson-Kelley was manufacturing—and delivering!—both *copper-lined* and *Solid Everdur* Hot Water Storage Heaters. And it's a pretty safe bet these units now in use are as good as new today! With good care, a Patterson Hot Water Storage Heater—lined with copper or built of Solid Everdur—will give years of dependable, trouble-free service. Think of what that means! A piece of equipment that has every chance of out-lasting the war—and then some. Plenty of hot water . . . and no *replacement* worries!

Of course, we're still making Patterson Hot Water Storage Heaters. But deliveries are subject to priority ratings. Even those units fabricated from *steel* are in the top priority class. Unless your priority rating warrants it, you'll have to wait until after the war to order a Patterson Heater. But when you do — remember how forcibly World War II *underscored* sound equipment values. For the last word in *serviceability*, specify *Everdur* or *copper-lined* in that post-war Patterson Hot Water Storage Heater—in that order!

PATTERSON-KELLEY *FOR DEPENDABLE, ECONOMICAL SERVICE*

EST. 1880

THE *Patterson-Kelley* CO., INC.
107 WARREN ST., EAST STROUDSBURG, PA.

ical example of this use is to be found in a large aircraft engine plant near the eastern seaboard, where five of the largest sized standard dehumidifiers are used in two finished part storerooms to prevent tarnish and corrosion of airplane engine parts.

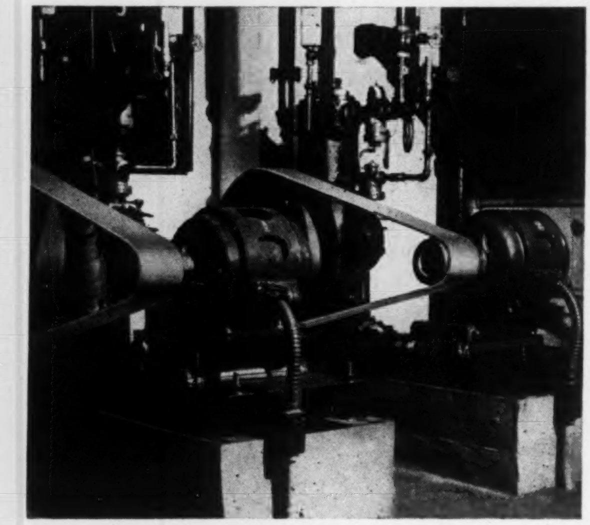
The testing of airplane engines, under stratosphere conditions, presents a typical problem successfully solved by direct dehumidification. Above 50,000 ft, the temperature of the air is constant at 67 deg below zero and it is practically bone dry. To simulate this air condition for testing purposes presents very real difficulties. One effective method is to cool the air to the dew point just above freezing by refrigeration, then dehydrate this air to a dew point of approximately minus 70 F, from which point it is carried down to the required final temperature by refrigeration without frosting problems.

The pharmaceutical industry produces obviously important material for war; drugs and vitamin concentrates are as necessary to our armed forces as to war workers at home. A great many installations of gas fired air conditioning equipment have been made for large pharmaceutical companies in this country.

The processed foods industry is being geared up to produce a wide range of dried foods, thus saving metal used in containers and greatly reducing shipping space. While most foods are dried by conventional heat drying methods, various phases of air conditioning are already being used in this industry and its acceptance as an important process aid is rapidly increasing. Drying equipment can be used to increase the capacity of existing apparatus by removing part of the moisture from the recirculated air in a closed system. Because of the hygroscopic nature of many food products after drying, it is apparent that means must be provided to prevent moisture regain during the packaging operation. This is accomplished by maintaining relative humidities below 30 per cent at dry bulb temperatures not exceeding 85 F.

Many other essential processes involve the use of heat activated equipment for air conditioning. Close control of humidity is essential in the processing of "compregnated"

**INSTALL IT;
FORGET IT!**



Dependable TANNATE-ROCKWOOD Drive automatically maintains correct belt tension . . . Gives long service, with low maintenance! This is the ideal air conditioning drive . . . For, if the load varies, the weight of the motor on the pivoted Rockwood base automatically adjusts the belt tension. And, thus, the Tannate leather belt always hugs the pulley—and always grips firmly, runs smoothly, transmits power steadily with high efficiency.

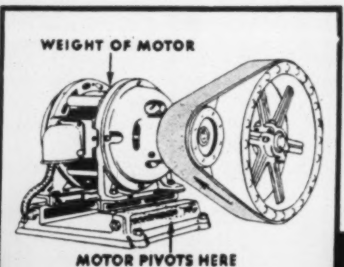
Not even exposure to water or machine oils impairs Tannate's performance, for, its special tannage and watershed ply-construction insures long service with minimum stretch, despite unfavorable operating conditions . . . and, with little or no maintenance other than an occasional application of Rhoads' Belt Dressing.

J. E. RHOADS & SONS

Established 1702

35 N. SIXTH STREET
PHILADELPHIA, PA.

NEW YORK • CHICAGO
ATLANTA • CLEVELAND



RHOADS

Tannate-Rockwood

PRODUCTION DRIVE

NEVER HARDENS...

PIPES ALWAYS EASY TO DISJOIN

Rutland is the Pipe Joint Cement that master piping contractors and plant engineers swear by—not at. It seals joints tightly—lasts indefinitely. Saves money because more bulk per pound. Legal for use in all cities because no toxic ingredients. Remains soft in can. Does not stain hands or fixtures.

Mail post card for free sample. Rutland Fire Clay Co., Dept. H-13, Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

RUTLAND
PASTE PIPE JOINT CEMENT
RUTLAND FIRE CLAY CO
RUTLAND, VT

wood which is being used experimentally in the production of an all plastic airplane. Gas fired air conditioning equipment is being used to provide this all important control of humidity. Bone dry rayon cords are being used extensively in place of cotton in the manufacture of improved pneumatic tires. Direct dehumidification equipment provides the essential dry atmosphere.

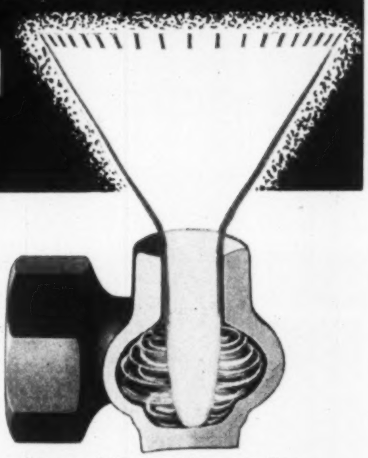
Industrial Hygiene Plant Surveys

Industrial Hygiene Foundation surveys frequently show that equipment for exhaust ventilation is used improperly, according to a report on What the Foundation Plant Surveys Are Disclosing, by Dr. Francis R. Holden, industrial hygienist, Industrial Hygiene Foundation, presented at the seventh annual meeting of the foundation. Often an exhaust system for controlling dust where batch cars are loaded has been designed, for reasons of economy, to have only a few chute exhausts in operation at any one time. Workmen through improper instruction or supervision will open all the exhaust valves, resulting in insufficient suction at any point to remove the dust.

Similarly, there is frequently a failure to provide adequate air to compensate for that removed by exhaust systems. This neglect is true especially in winter when windows and doors are closed. The result is that the required amount of air cannot be removed and unless the system has been greatly overdesigned, the health hazard will not be controlled. At least as much air should be provided as will be exhausted and this air should be conditioned during cold weather. By means of louvers it is possible to feed air into the room, avoiding drafts.

A number of cases were observed where an opera-

CUT OPERATING COSTS
WITH
Engineered
Nozzles



This "Whirljet" Nozzle employs centrifugal action to produce its hollow cone spray-pattern. No cores, vanes or obstructions are present and all inside surfaces are smoothly rounded.

The Spraying Systems nozzles used in washing, cooling and humidifying phases of Air Conditioning are specifically designed for the jobs they do. Each nozzle produces exactly the right kind of spray for the purpose. Atomization, capacity and spray angle are pre-determined so that efficient operation may be secured at minimum cost.

Any Air Conditioning installation can benefit from the precise methods and engineering experience incorporated in our nozzles. Secure the benefits of our 18 years of specialization in nozzle engineering and manufacture. For suggestions to help solve your spraying problems write today to

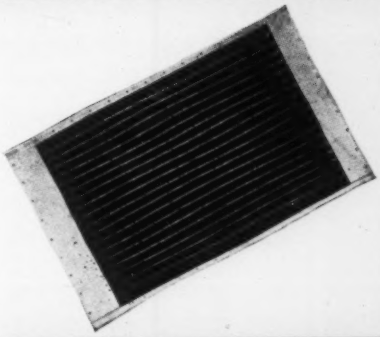
SPRAYING SYSTEMS COMPANY
4033 West Lake Street, Chicago, Illinois

SPECIALISTS IN THE DESIGN AND MANUFACTURE OF SPRAY NOZZLES

McCORD
HEATING AND AIR CONDITIONING PRODUCTS

YOU CAN DEPEND ON McCORD Air Conditioning Products

BLAST HEATING COILS
AIR CONDITIONING COILS
-ALL TYPES

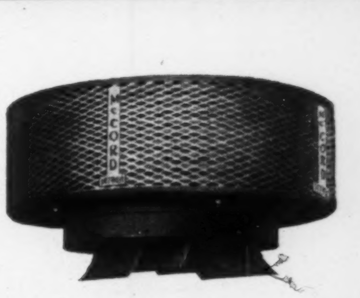


Tube fin construction, high heat conductivity. Fins metallically bonded.
Ask for catalog.

HORIZONTAL TYPE UNIT HEATERS

Distinctive modern design, rugged, dependable heating core, high heat transfer capacity. Core spring mounted. Specify McCord.

VERTICAL TYPE UNIT HEATERS



Proven modern design, spiral fin tube core. Supplied with air diffusers, louver, multi-cone or anemostat type outlet. Quotation on request.

McCord RADIATOR & MFG. CO.
DETROIT, MICHIGAN

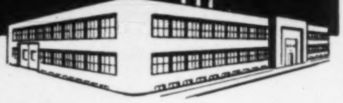
tion would be exhausted by means of a fan situated in a wall near a window or through a portion of a large window. Workmen desiring to increase the ventilation will open the window, setting up a return air current that carries the dust, gas, vapor, or fume back into the workplace. The fallacy of this procedure can be illustrated by means of a smoke bomb, which clearly shows the exhausted material returning to the room through the open window. Cases also were found where dangerous gas, vapor, dust, or fume enters adjoining departments through open windows after having been exhausted from an operation nearby. The obvious answer is to extend the exhaust duct above the level of the roof.

During an inspection of a spray booth department in a large plant, it was seen that the exhaust system was not operating. It had been shut down because of a complaint from a nearby department that the vapors made the men sick. The vapors were exhausted into a court, exposing many workmen to a hazard that was not a part of their job.

The use and care of respirators continue to be problems in spite of the know how information published by the U. S. Bureau of Mines and other organizations. Most surveys disclose at least one case where the wrong respirator is used. A most common mistake is the employment of dust respirators for protection against vapors. There are also many instances where the maintenance of respirators is inadequate or negligible. Under such circumstances it is difficult to obtain the necessary cooperation from the workers. Wearing a respirator is usually a new experience for a recently employed workman. He must be taught to

Young

HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

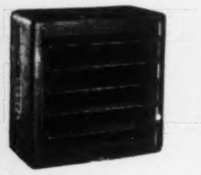


for WARTIME NEEDS OF INDUSTRY

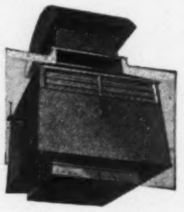
No matter what your special needs may be, there is a YOUNG steel heating, ventilating or air conditioning unit designed and engineered by YOUNG for long life and maximum output. Your inquiry will bring complete information and specifications on this new type equipment.

YOUNG RADIATOR COMPANY
Dept. 113-A Racine, Wis., U. S. A.

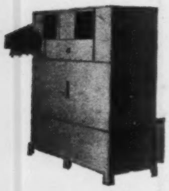
Vertiflow Unit Heaters for ceiling suspension. Propeller fan, vertical discharge. 10 models.



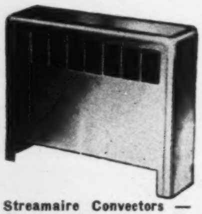
Horizontal Discharge Unit Heaters. 10 sizes of propeller fan type units.



New Vertivent Blackout heater and ventilator for roof installation in war plants.



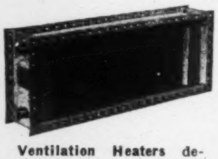
Streamaire Air-Conditioning Units 16 models, capacities from 400 to 16,600 CFM.



Streamaire Convectors — Four cabinet types designed for any steam or hot water system.

Water Coils — Continuous tube type. Direct expansion evaporator coils on special order.

Heating Coils. Standard or steam-distributing tube types.



Ventilation Heaters designed with copper coils for marine heating and ventilating.

COPPER UNITS are available with copper coil construction for military contracts and essential industries where permitted.

The Young Radiator Company manufactures many types of specialized heat transfer equipment for the Army and Navy . . . for military planes, Army tanks, scout cars, PT boats, and other applications.

Young

HEATING, COOLING AND AIR CONDITIONING UNITS

Specify STANDFORATED PERFORATION OF ALL METALS

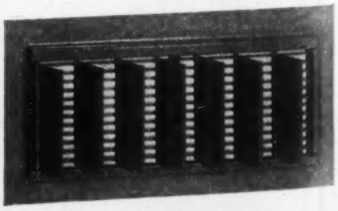
ADJUSTABLE AIR CONTROL GRILLES

Perfect for Defense Projects!

STANDFORATED Precision Processing provides top quality and super-efficiency at moderate cost. Scientific design, strength and durability meet rigid specifications for all types of Defense Building!

QUALITY EFFICIENT VOLUME CONTROL REGISTERS

No. 500HA — 4-Way Deflection. Vertical deflecting louvres on back individually operated left or right. Horizontal grille bars on face adjustable in groups for up or down deflection.



STANDARD
STAMPING & PERFORATING COMPANY
3151 W. 49th PLACE • CHICAGO, ILLINOIS

WRITE FOR CATALOG
STANDFORATED GRILLES
BEND-EZY REGISTERS
INDUSTRIAL & ORNAMENTAL
PERFORATIONS & STAMPINGS

obtain a comfortable fit and the reason for the respirator should invariably be explained.

Many companies have their troubles in getting workmen to wear respirators. But a clay products firm had the opposite experience. A general order warned in effect that employees would wear their respirators "or else." One wintry morning the plant manager coming to work found the janitor busily sweeping snow and wearing a respirator.

Not all industrial health problems are solved by specialists. A recent hazard involved exposure to a material which is a skin irritant. Glass plates were immersed in a mixture of an unpolymerized resin and in spite of the utmost care some of the resin would wet the clothes of the worker. The liquid would then remain in contact with the skin for several hours, producing a dermatitis. Rubber and cloth aprons were of no value as the resin penetrated them. The mother of one of the girl workers suggested that a sheet of the polymerized resin itself would be impervious to the liquid. Several thin sheets were then prepared and proved an absolute protection.

"Criminal negligence" regarding one's own health and safety is an ever present problem. An inspection of an acid pickling process in a steel plant disclosed what appeared to be complete disregard for the potential dangers of the acids by the workers exposed. Nevertheless, the accident and health experience in this department had been excellent with one exception. A workman decided to clean thoroughly his dinner bucket after finishing his turn. He dampened a cloth with concentrated hydrofluoric acid and proceeded with

U. S. GAUGES

For·Steam and Hot Water Boilers

25
30
35
40
45
20
15
10
5
0
U.S. GAUGE
NEW YORK
PRESSURE

For service on Steam Heating Systems—
Steam Gauges . . . Compound Pressure and Vacuum Gauges . . . Retard Gauges . . . Compound Retard Gauges . . . Steam Gauges with Internal Siphons.

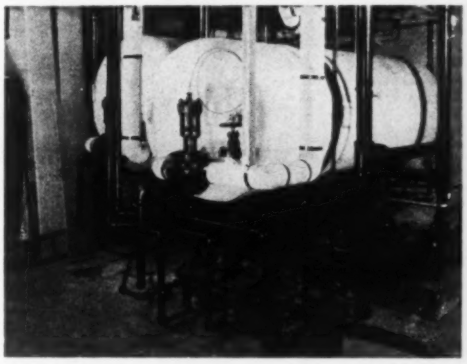
For Hot Water Heating Systems—
Altitude Gauges . . . Tank-in-Basement Gauges . . . Altitude and Pressure Gauges . . . Combination Altitude Gauges, and (a) Bimetal Thermometers, (b) Glass Tube Thermometers, (c) Vapor Tension Distance Type Thermometers . . . Glass Tube Hot Water Thermometers.

U. S. GAUGE CO.
44 Beaver Street
New York

WHITLOCK

Manufacturers, Since 1891, Of

Heat Transfer Equipment



Here are a few things you can do to make your Whitlock Storage Heater last longer and operate more efficiently.

1. IF THE HEATER SHELL IS RUSTING, you can have it cement-lined to prolong its life; and eliminate troubles due to "red water."
2. IF YOU USE LIVE STEAM, you can check your steam regulating valve to be sure it is operating at the correct temperatures—this may save valuable fuel.
3. IF YOU NEED MORE HOT WATER CAPACITY, you may be able to increase the steam pressure, as all heating sections are designed and tested for pressures well above working pressure specified. (CAUTION: Do not increase pressure without consulting your insurance company.)
4. IN ANY CASE, YOU CAN KEEP YOUR HEATER CLEAN by blowing out accumulated "mud" occasionally. And you can check your water relief valve to see that it is seating properly—that it is operating at pressure for which it is set.

IF FACED WITH AN ACTUAL EMERGENCY—

5. UNDER SOME CONDITIONS, YOU CAN BUY steel tubes to replace copper, or even a whole heating section; BUT, in such cases, applications on WPB Form PD 615 should be made promptly on the placing or anticipation of an order.

CONSULT THE NEAREST WHITLOCK OFFICE

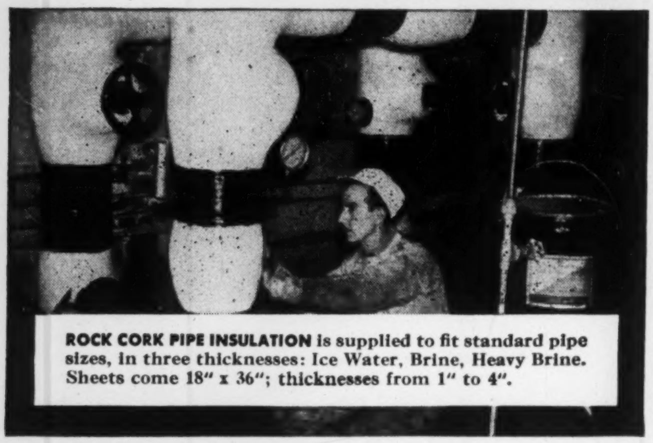
We cannot sell you much these days, but we can offer friendly service in helping you to keep your present equipment in operation; in advising on specific troubles; and in helping with the filling out of WPB Forms.

THE WHITLOCK MANUFACTURING CO.
44 South Street • Elmwood, Hartford, Conn.
DISTRICT OFFICES IN
New York • Chicago • Boston • Philadelphia
Detroit • Richmond

Here's why
ROCK CORK
Delivers
LASTING INSULATING
EFFICIENCY

Basically mineral, this time-tried J-M Material provides these five essential features in every refrigerated service . . .

1. RETAINS LOW CONDUCTIVITY
2. DOES NOT ABSORB ODORS
3. THOROUGHLY SEALED AGAINST MOISTURE
4. IMMUNE TO TERMITES, VERMIN, MOLD. CAN'T ROT
5. STRUCTURALLY STRONG



ROCK CORK PIPE INSULATION is supplied to fit standard pipe sizes, in three thicknesses: Ice Water, Brine, Heavy Brine. Sheets come 18" x 36"; thicknesses from 1" to 4".

IT IS BECAUSE of these qualities that installations of J-M Rock Cork are still in excellent condition . . . still providing exceptionally high efficiency . . . after 15, 20, and more years of service. Available in sheets and as sectional pipe-covering. For full details, write for data book DS-555. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM
Johns-Manville
ROCK CORK
SHEETS AND PIPE INSULATION

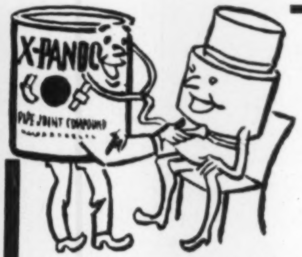
the cleaning. The next day his hands were in a very serious condition and grew, rapidly worse. It was finally necessary to amputate several of the fingers to arrest the necrosis which resulted.

There is needed a middle ground between frightening a workman to the point where he is of little value and where he shows a wilful disregard or ignorance for the dangers of his occupation. A continuous systematic program of education and supervision administered by foremen and supervisors, backed by top management, has demonstrated its practical worth.

Measuring Air Flow in Industrial Ventilation

The Industrial Hygiene Foundation of America, Inc., 4400 Fifth Ave., Pittsburgh, Pa., issued recently part 2 of bulletin No. 3 in its preventive engineering series, on Measuring Air Flow in Industrial Ventilation. This 18 p. booklet has been distributed to members of the foundation and is available at 75c a copy to nonmembers.

Control of industrial health hazards commonly involves application of ventilation, the most important element of which is the rate of air flow—plant engineers and industrial hygienists therefore should be able to measure the flow quickly and with facility. Data are included in the booklet on air flow and static suction, technique of measurement, the hood entry coefficient, exhaust from chambers, velocity pressure measurements, the pitot tube and its accessories, air flow through ventilation openings, and air velocity at



CORRECTS
IMPERFECTIONS
in Threads and
FLANGE FACES

Positive expansion after setting does more than end leaks permanently. It smooths flange faces and corrects imperfect or burred threads. In these days when piping is hard to get, this exclusive X-Pando Pipe Compound feature means that you can *repair* pipe joints you would ordinarily be forced to throw out. Get to know X-Pando—ask your local mill supply house. There's an X-Pando distributor near you.

X-PANDO
PIPE JOINT
Compound

Expands as it sets. One formula for all uses. Goes 4 to 6 times further than ordinary compounds. Better than litharge and glycerin for all uses. Expands and contracts with pipe movement. Not affected by vibration, deflection, temperature or pressures. The perfect sealing compound. Holds anything carried in metal pipe except some heavy acids.

*See Your Local Mill Supply House—
Distributors Everywhere*

X-PANDO
EXPANDS AS IT SETS
PIPE JOINT COMPOUND

X-PANDO CORPORATION
43-15 – 36th Street · Long Island City, N. Y. · STilwell 4-7180
Canadian Distributors La Salle Products Ltd., 159 Jean Talon St. W. Montreal, Quebec, Canada

a point in space. There are tables of pipe areas, velocities corresponding to various velocity pressures, and a list of references (including the article by W. C. L. Hemeon on How Plant Engineers Can Make Field Measurements of Industrial Ventilation, which appeared in HPAC for January, 1941.)

War Housing Manual

The housing branch of the construction bureau of the War Production Board, Washington, D. C., has issued a 38 p. war housing manual which includes the war housing critical list and information on procedures for processing applications as of December 12. There is also information on the basis of the housing program, WPB orders affecting war housing, data on applications for ratings for both privately and publicly financed projects, and material on utility allowances.

The purpose of the manual is to present in a general way a digest of procedures and requirements covering the filing and processing of applications and it is intended to clarify procedures in the minds of those sponsoring, financing, constructing, and furnishing materials for projects that qualify under the war housing program.

Building Code for Dwelling Construction

Report BMS88 of the building materials and structures series issued by the National Bureau of Standards of the U. S. Department of Commerce presents recommended building code requirements for new dwelling construction, with special reference to war

AIR CONDITIONING NOZZLES

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-616.

YARNALL-WARING COMPANY
107 MERMAID AVENUE
PHILADELPHIA

YARWAY

ACME PRODUCTS ★★★

24 years' service to the industry
You don't have to sacrifice quality for price
BUY ACME

EVAPORATIVE CONDENSERS
All Prime Surface Cooling Coils—Copper or Steel

AMMONIA CONDENSERS
Shell and Tube—Horizontal or Vertcial

FREON CONDENSERS
Shell and Tube—Steel or Copper

DIRECT EXPANSION WATER CHILLERS
Indirect Air Conditioning and Processing Water

FLOODED WATER CHILLERS
Drinking and Ingredient Water

BRINE COOLERS
Steel Tubing or Pipe

HI-PEAK WATER COOLERS
Storage Type, Direct Expansion

CASCADE WATER COOLERS
Aerator Type, Bottling Plants

FINNED COILS
Air Conditioning—Low Temp.

PIPE COILS
Steel—1/2" to 2"

HEAT INTERCHANGERS
Refrigerant Suction Line—Liquid to Gas

OIL SEPARATORS
Separators—Not Traps

LIQUID RECEIVERS
Refrigerant

ACCUMULATORS SURGE DRUMS
Refrigerant

FORCED CONVECTION UNITS
Cold Dispensers

SHELL AND TUBE HEAT EXCHANGERS
Liquid to Liquid—Gas to Gas, etc.

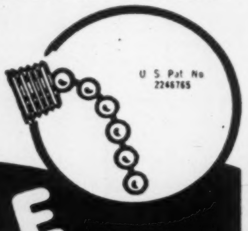
OUR GOVERNMENT, OF COURSE, HAS FIRST CALL ON OUR FACILITIES BUT WE ARE STILL ABLE TO ENTERTAIN YOUR INQUIRIES AND ORDERS IF APPROVED FOR MANUFACTURE BY W.P.B. WE WANT TO SERVE YOU.

ACME INDUSTRIES
JACKSON • MICHIGAN

Thermal Bellows Units
for
THERMOSTATIC STEAM TRAPS

CLIFFORD MANUFACTURING CO.
564 E. FIRST STREET, BOSTON
CHICAGO **DETROIT**
Producers of bellows exclusively serving automatic control manufacturers

"DROP-BY-DROP" DRAINAGE
FEATURED EXCLUSIVELY ON
M. S. LITTLE AIR VALVES



FLEXIBLE SYPHON

Save Fuel! FLEXIBLE SYPHON, a patented M. S. LITTLE feature, is a simple and positive method of effectively draining radiators, preventing water-logged conditions and a sure way of Saving Fuel.

M. S. LITTLE Valves with FLEXIBLE SYPHON are easier to install—no tubes to cut or bend. Nothing to get out-of-order.

Laboratory tests prove conclusively the unfailing performance of M. S. LITTLE Valves with the FLEXIBLE SYPHON feature. Faster heating, more efficient and fuel saving.

No. L-50

The complete line of M. S. LITTLE Valves include those of the adjustable and non-adjustable types.

Cataloged by Leading Wholesalers

MADE BY M. S. Little
TUBULAR BRASS PLUMBING GOODS — HEATING SPECIALTIES
THE M. S. LITTLE MFG. CO. HARTFORD, CONN. U. S. A.

housing. Copies of the report are for sale by the Superintendent of Documents, Washington, D. C., for 20c.

A series of recommended requirements suitable for use in building codes is presented. These requirements apply to single and two family houses and to multiple dwellings of limited height. They cover such matters as fire resistance, light and ventilation, exits, strength of construction, and chimneys and fireplaces. In general, good practice is required, certain well-recognized standards and specifications being cited as acceptable evidence of good practice. Specific dimensions and other details are given where necessary. The report contains an appendix in which additional information is given, including methods of meeting specific code provisions and references to source material.

Glossary of Housing Terms

The National Bureau of Standards of the U. S. Department of Commerce has issued a glossary of housing terms as Report BMS91 of the Building Materials and Structures series. Copies of this 32 p. report are for sale by the Superintendent of Documents, Washington, D. C., for 15 cents each.

The purpose of the glossary is to bring together for convenient use of all persons concerned with housing the generally accepted definitions of a limited number of terms currently used in housing literature. Following are some of the definitions as given in the glossary:

Air conditioning.—The simultaneous control of temperature, humidity, movement, and purity of air in buildings.

Cubic content of a building.—As determined by any prescribed method for use in estimating total construction costs, such as method used by Rental Housing Division,

★**HELPFUL counsel**
on wartime heating problems
. . . yours for the asking!

Come on, . . . let us help you as we're helping others during these stirring days. Where priorities make their installation possible, Fire-Guards will give trouble-free, efficient service—actually save you money. As a contractor you owe it to yourself to investigate!

FIRE-GUARD
Automatic Coal Stokers

Sizes from 10 to 400 lbs. capacity

Wire, Phone or Write NOW!
PEERLESS MFG. CORP. Louisville, Ky.
Heating Equipment for 58 years

Federal Housing Administration, viz., the volume of a building is derived by multiplying the area of a building (see definition) by the height figured as follows: Where flat roofs with parapets occur, a point 6 in. above the roof is taken. Where sloping roofs occur, one-half the height of the slope is used. Where basements occur, a point 6 in. below the basement slab is used. Where no basements occur, the point varies depending upon the depth of the foundation walls. For example, with a 2 ft 6 in. foundation wall, a point 6 in. below the floor construction is used. Where the foundation walls are 4 ft deep, a point 2 ft below the first floor construction is used. Other depths are figured in proportion. Dormers, chimneys, and other protrusions from the building proper are figured separately.

Thermostat.—An instrument that controls automatically the operation of heating or cooling devices by responding to changes in temperature.

Ventilation.—The process of supplying and removing air by natural or mechanical means to or from any space. (Such air may or may not have been conditioned.)

Cross ventilation (natural).—Ventilation through openings in adjacent outside walls. (Sometimes called "corner ventilation.")

Through ventilation (natural).—Ventilation through openings in opposite outside walls. (Sometimes called "cross ventilation.")

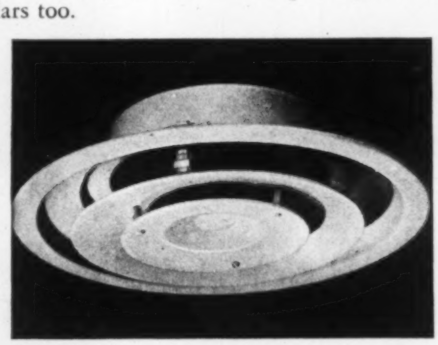
Straight Screw Threads for High Temperature Bolting

Increasing use of high pressures and temperatures in piping and pressure vessels has emphasized the need for a standard screw thread practice especially designed to meet the requirements such service demands of the bolting. An American Standards Association war standard on straight screw threads for high temperature bolting for use with pressure vessels and steel pipe flanges, fittings, and valves, has been developed

KNO-DRAFT K-NEWS

HOW TO DO A BETTER JOB FOR LESS!

The Kno-Draft* type W-A-R Air Diffuser points the way—redesigned to obtain even better performance while cutting the material in half—and passing on the savings in dollars too.



All of the Kno-Draft exclusive features are retained—draftless and noiseless uniform air diffusion—thorough air mixing—room temperature equalization—greater air volumes with lower resistance.
Also, **adjustability** to suit the season or the job.

**Formerly known as Dorex Kno-Draft Air Diffuser*

WB CONNOR ENGINEERING CORP.

W. B. CONNOR ENGINEERING CORP.
114 East 32nd Street New York, N. Y.

POWERS
TEMPERATURE and HUMIDITY
CONTROL

When you want accurate and dependable automatic temperature or humidity control for Heating, Ventilating and Air Conditioning Systems or Industrial Processes call in a Powers engineer. With a very complete line of self-operating and compressed air operated controls we are well equipped to fill your requirements.

THE POWERS REGULATOR CO.
2759 Greenview Avenue, CHICAGO
Offices in 47 Cities—See your phone directory

★ **Over 50 Years** ★
of Temperature and Humidity Control

GREEN LIGHT FOR INDUSTRY

*SARAN PLASTIC PIPE, TUBING, FITTINGS

SARAN by HODGMAN is a tough thermoplastic specially made to replace strategic materials. It is adaptable for use under high working and bursting pressures and is resistant to most chemicals. Its ease of handling makes it extremely valuable in installations requiring the transport of oil, gas and corrosive chemicals.

*Pat. No. 2160931

Send FOR COMPLETE INFORMATION SHEET AND FREE SAMPLE

HODGMAN RUBBER CO.
FRAMINGHAM, MASS.
NEW YORK 261 Fifth Avenue CHICAGO 412 South Wells St. SAN FRANCISCO 121 Second St.

PERFORMANCE PLUS
with
Economy
SCV *Pumps*

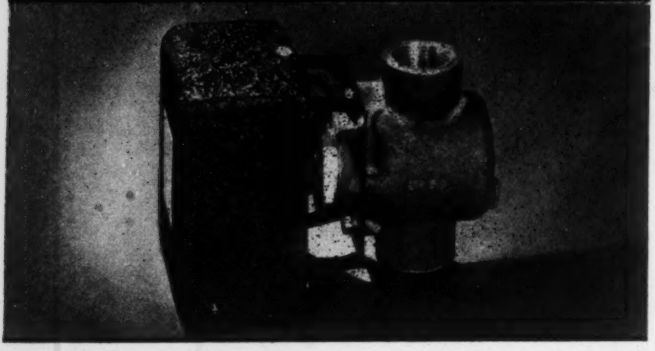
Engineered for utmost efficiency, this new SCV Economy Pump gives assurance of years of trouble-free service. Reducing maintenance costs and eliminating costly shut-downs is a great contribution to the war effort. Economy Pumps give assurance of uninterrupted service in air conditioning systems . . . water (hot or cold) and brine circulating line . . . sprinkler systems . . . boiler feeding . . . pressure boosting, etc. They handle from 10 to 500 GPM . . . vertical construction conserves floor space and keeps the motor above floor level, away from dirt and water. Economy Pumps are always aligned, easily accessible, and keep clear liquids flowing.

Write for free 256-page book on Pump care and maintenance and for catalog D2-1042 which completely describes the new SCV pumps.

ECONOMY PUMPS, INC.
1011 WELLER AVENUE — HAMILTON, OHIO

LOW WATER CUT-OUTS
ALL-ELECTRIC—FOR OIL, COAL AND GAS-FIRED BOILERS
—They're just right!

NO MOVING PARTS IN WATER • NO STUFFING BOXES OR PACKING GLANDS • SMALL ELECTRODE CHAMBER—MINIMUM SLUDGING-UP LIGHT IN WEIGHT—COMPACT—GOOD LOOKING • GREATER SAFETY FROM POSITIVE CONTROL • LONGER SERVICE LIFE—GREATER SERVICE ABILITY • FURNISHED FOR LINE VOLTAGE AND MOTOR CAPACITIES 1 h.p. R.I.—½ h.p. S.P. • PRESSURES, FROM LOW TO 150 LBS. MAX.



THE ONLY MOVING PART of this cut out is the armature and mercury tube. Nothing to wear out, or fail to function. Small volume electrode chamber minimizes settling of suspended particles or mudding-up. Dual voltage coils permit either 115 v. or 230 v. A.C. connections on the job. Low electrode voltage. Electrode insulators guaranteed to withstand action of steam and water under pressure. Adaptable to all units requiring 1" IPS connections, at pressures up to 150 pounds and temperatures to 366° F. Available with alarm circuit. Other models for various mountings described **In No. 52** Catalog. Request your copy.

GENERAL CONTROLS
450 East Ohio St., Chicago, Ill. 267 Fifth Ave., New York City

by a subcommittee of ASA committee B1 on screw threads and received ASA approval on November 6.

Copies of this new war standard, identified as B1.4—1942, are available at 25c each from the American Standards Association, 29 W. 39th St., New York, N. Y.

Reducing Maintenance Costs

Two Hundred Ways to Reduce Engineering and Maintenance Costs in Hotels, Hospitals, Apartments, and Institutions is a little book that contains a number of interesting items of value to anyone directly interested in the maintenance and operation of the mechanical equipment of buildings. At the least, the book should serve as a good check list of those items which an operating engineer ought to look into from time to time. It covers in terse form air conditioning costs; refrigerating costs; cost of electricity; maintenance tips; engineering records; and fuel, steam, and water control.

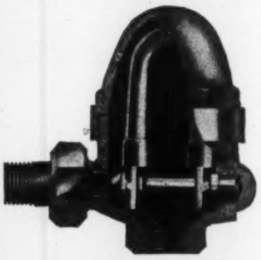
There are many thought-provoking suggestions which are sure to serve as prods and suggest new ideas to those in charge of equipment.

Publisher of this 144 p., 4 by 6 in. volume is The Dahls, Haviland Rd., Stamford, Conn. The price is $1.00.

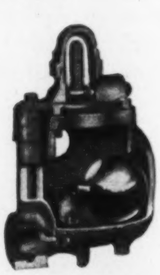
Heat Engineering Principles

Principles of Heat Engineering, by Neil P. Bailey, of the General Electric Co., covers in textbook fashion the fundamentals of thermodynamics as usually taught to undergraduate engineering students. The material is well arranged. There are chapters on basic concepts,

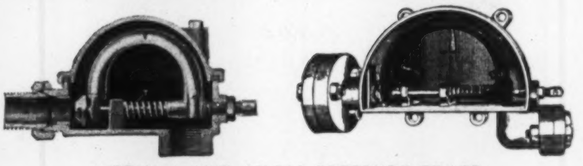
HAINES TRAPS
A TRAP FOR EVERY STEAM HEATING
AND PROCESS PURPOSE



RADIATOR TRAP



F & T TRAP



MEDIUM AND HIGH PRESSURE TRAPS

Each Trap Is Individually Tested, Factory Adjusted and Guaranteed

WILLIAM S. HAINES & CO.
460 N. TWELFTH ST.
PHILADELPHIA

characteristics of gases, energy, combustion of fuels, heat transfer, compression of gases, steam engines and turbines, and several other topics necessary for an undergraduate course in thermodynamics.

The presentation is logical and the writing is clear and straightforward. All in all, this should prove an interesting addition to the newer books on thermodynamics and should be useful both for teaching and for basic reference purposes.

The publisher is John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price of this 275 p., 6 by 9 in. book is $2.75.

University Offers Aid to Writers in Technical Fields

The needs of the technical worker or the professional man who knows his subject but may lack certain skills in writing about it to meet precise editorial standards are kept in view in a university correspondence course, Specialized Exposition, offered by the extension division of the University of Wisconsin, Madison.

As outlined for interested students in any state, especially those in technical fields, this course encourages original composition on topics related to a student's daily work, with the aim of providing effective training in preparing articles for publication, business letters, and reports. Emphasis is placed on proper organization and arrangement of materials, an effective professional style, the important points in paragraphing, punctuation, capitalization, abbreviation, and proofreading, and other requisites commonly weighed in the editorial scales.

Only $2.00 for
This Outstanding Book
on Air Conditioning

THIRD EDITION

AIR CONDITIONING FOR COMFORT

By Samuel R. Lewis

288 Pages — 6½ x 9½ — Cloth Bound

Easy to understand . . . accurate . . . comprehensive . . . these are the features of this third edition of Samuel R. Lewis' well-known AIR CONDITIONING FOR COMFORT. More than 70% of the text in this third edition is entirely new, as are dozens of the illustrations, charts, tables, and designing examples.

Fundamentals are fully and clearly covered in this volume, as are the newest air conditioning methods and equipment. Correct procedure in designing complete systems for both residences and large buildings is explained step by step from the standpoint of newest practice. In addition, considerable original data on such comparatively new subjects as standards, noise control, measurements, and fire protection codes has been included.

Send $2.00 for a copy today to the address below. We know you will consider this one of the finest air conditioning books you have yet seen, but if you should be dissatisfied with it for any reason whatever, your money will be promptly returned to you.

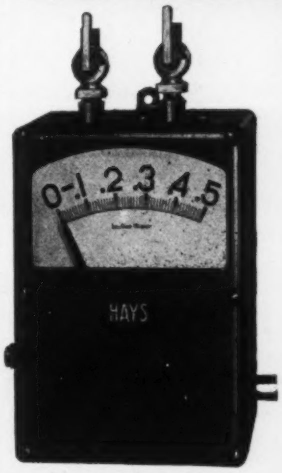
KEENEY PUBLISHING COMPANY
6 N. Michigan Avenue **Chicago, Ill.**

QUIET MAY

The trouble-free dependability of Quiet May oil burners demonstrates the kind of engineering that has gone into their design and manufacture. Quiet May's engineers are now working to help win the war. When peace comes, they will again devote their skill to keeping American homes more comfortable . . . for *less*. May Oil Burner Corporation, Baltimore, Maryland.

● **OIL BURNERS**

DIRTY FILTERS
can ruin the efficiency of the best air-conditioning system made....



THIS Hays Air Filter Gage gives a constant check on Air Filter conditions. It prevents changing filters sooner than necessary and warns when they are clogged with dirt.

The Hays Air Filter Gage is permanently and easily installed — nothing to get out of order. Will last as long as the duct work. Write 990 Eighth Avenue, Michigan City, Ind., for special Bulletin No. 40-278.

The HAYS CORPORATION
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

De-Sta-Co

Blower Wheel Housings

of Standard Dimensions

Made in sizes to fit 4½, 5, 6, 7½ and 9 inch wheels and in widths to suit single or double inlet wheels . . . also individual parts for your own assembly.

De-Sta-Co housings are engineered for maximum efficiency and quietness in operation . . . neatly finished. Send for "De-Sta-Co Blower Housings" bulletin; gives complete information, including essential dimensions.

DETROIT STAMPING CO.

Established Over 25 Years

337 Midland Ave • Detroit, Mich.

G&O COILS

G&O
RADIATION

Detail of mechanical joint used in Universal Heat Transfer Coils.

FOR HEATING AND COOLING IN A WIDE RANGE OF SIZES

Send for Catalog

THE G&O MANUFACTURING COMPANY

New Haven, Connecticut

Pioneer Manufacturers of Square Finned Tubing in the United States

Steel Piping Specifications

For the first time, the American Society for Testing Materials has compiled in one compact volume all of its specifications covering steel piping materials, most of which have been developed through the work of committee A-1 on steel. Ten of the specifications cover boiler, superheater, and miscellaneous tubes, many of which are incorporated in the ASME boiler code and other codes. The society's work in the field of piping has been outstanding, and there are 15 specifications covering various types of pipe for service at normal and also elevated temperatures.

The ASTM steel committee is in close cooperation with the petroleum industry and has carried out important standardization work on still tubes for refinery service and heat exchanger and condenser tubes, there being five standards for these materials.

To make the publication complete there are five specifications covering castings which are widely used for valves and related materials, four pertain to forgings and fittings, three cover carbon and alloy steel nuts and bolting material, and for convenience the standard austenite grain size chart (E 19) is embodied in the book.

For convenience all specifications and tests are arranged in numerical order of the serial designation, with a table of contents listing the specifications according to the material covered—that is, pipe, bolting, castings, and so forth.

To expedite procurement and conserve critical and strategic materials, many ASTM emergency alternate provisions have been issued in the piping field. These provisions are incorporated as part of this book.

Copies of the 256 p. publication can be obtained from ASTM headquarters, 260 S. Broad St., Philadelphia, Pa., at $1.75 per copy; on orders from 10 to 49 copies a price of $1.25 applies.

Coming Events

Heating and Ventilating Engineers

American Society of Heating and Ventilating Engineers: 49th annual meeting, January 25-27, Hotel Gibson, Cincinnati, Ohio. See ASHVE Journal Section in this issue for program and other information. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Foundry War Production

American Foundrymen's Association: 47th annual meeting, April 28-30, Hotels Jefferson and Statler, St. Louis, Mo. Meeting is to be a "mobilization of management, technical, and operating men for devising ways and means for extending use of cast metals in the war effort." Headquarters office of the AFA is at 222 W. Adams St., Chicago, Ill.

Smoke Prevention

Smoke Prevention Association: 37th annual meeting, June 8-11, Hotel William Penn, Pittsburgh, Pa. Headquarters office, 139 N. Clark St., Chicago, Ill.

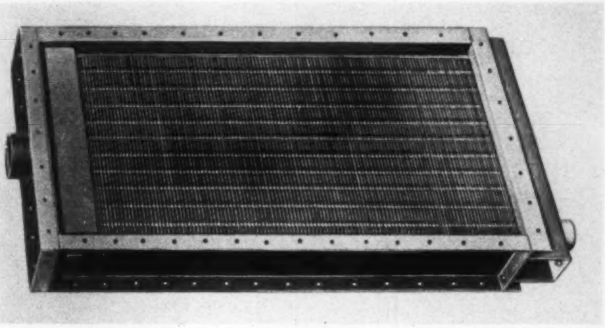
Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1943, HEATING, PIPING & AIR CONDITIONING *and thus keep your records of sources of supply up to date throughout the year. Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.*

Steel Heating Coils

No. 2397—A new line of steel heating coils, for use in food dehydration and industrial processing, includes standard types and steam distribution types, the latter for use where subfreezing inlet air is introduced. These coils are also applicable for use in heating, ventilating and air conditioning systems. They are of steel construction throughout to save critical copper and its alloys.

To protect the steel fins from atmospheric corrosion, the entire coil is dipped in a special lead alloy bath. The tubes have heavy wall thicknesses to insure maximum resistance to internal steam corrosion. The fins are bonded permanently to the tubes with metal.



According to the manufacturer, patented die forming of the fins gives effective turbulence to the air with a minimum of air resistance. Cases are designed for duct installation in end vertical, side vertical, or horizontal position.

These coils are guaranteed to withstand hydrostatic pressure up to 500 psi or operating steam pressure up to 150 psi.—Modine Mfg. Co., 1772 Racine St., Racine, Wis.

Improved Nonmetallic Sheets

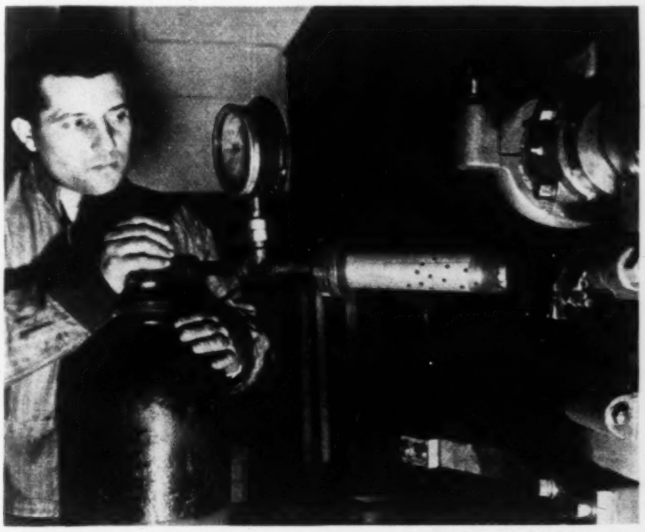
No. 2398—Improved "A.R.A." sheets, which are used as an alternate or a substitute for sheet metal, have been announced. They now have asbestos protection of new appearance on both the inside and outside surfaces, which, according to the manufacturer, is extremely important in all types of heating, ventilating, and air conditioning equipment.

These sheets are designed and constructed for easy fabrication into the usual heating and air conditioning duct and fitting shapes. Regular metal shop equipment may be used and the sheets can be die-cut or notched, rolled, creased, scored, and bent.

These sheets have thermal insulating value and, according to tests, the K coefficient is 0.45 Btu.—Grant Wilson, Inc., 4115 W. Taylor St., Chicago, Ill.

Safety Device for Testing Operations

No. 2399—Rocky Caruso, war worker at a Walter Kidde Co. plant which makes inflation cylinders for Army and Navy airmen's life rafts, was first in a series of "safety aces" to be honored by the War Production Fund to Conserve Manpower for their good work in keeping production lines free of accidents.



Caruso was cited for his invention of a device which catches flying metal splinters and muffles loud explosions in an important testing operation. With the award goes a $100 victory bond, presented each week to a "safety ace" by Col. John Stilwell, president of the National Safety Council.

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [2-43]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature.

(Circle each number in which you are interested):

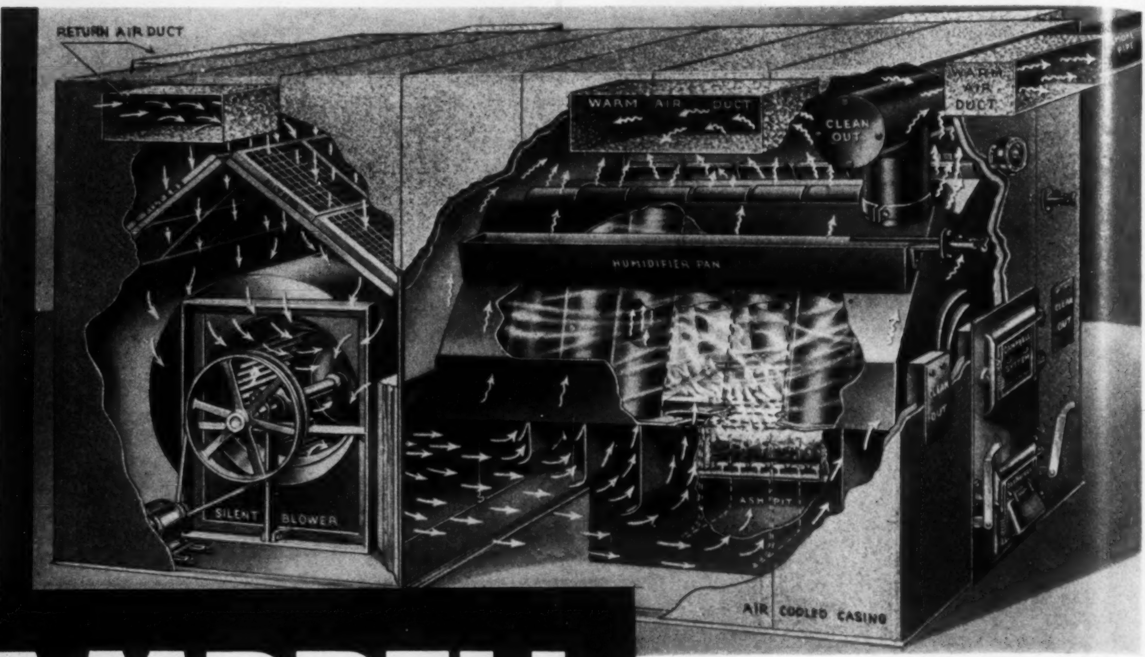
2397 2398 2399 2400 2401
4366 4367 4368 4369 4370 4371 4372 4373 4374 4375
4376 4377 4378 4379 4380

Name .... Title..............

Company ....

Address ....

City .... State..............


RETURN AIR DUCT
WARM AIR DUCT
CLEAN OUT
WARM AIR DUCT
HUMIDIFIER PAN
SILENT BLOWER
ASH PIT
AIR COOLED CASING

CAMPBELL
8000 SERIES
HEATERS
for large buildings, industrial plants, etc.

Campbell 8000 Series "Winter-Chaser" Air Conditioner—a complete, self-contained heating unit.

● Highly efficient and economical, the Campbell 8000 Series is a real boon to heating engineers and contractors—because it supplies the answer to the problem of properly heating large structures, such as war plants and industrial buildings.

In capacities ranging from 725,000 to 2,160,000 B.t.u. per hour, Campbell Heaters are available for coal or stoker firing; gas or oil.

Designed by expert heating engineers, and backed by 63 years of successful heating experience, Campbell Heaters are guaranteed to give long, efficient service and to deliver their full rated capacity.

Prompt Delivery on Rated Orders
Write for full details and attractive prices.

Campbell Heating Company
DES MOINES, IOWA

LIFEBLOOD

In more than 100,000 industrial plants, Dayton V-Belts are the arteries through which pulse the lifeblood of productive power . . . power that is smooth-flowing and dependable . . . power which enables millions of machines of every type to convert raw materials into battle weapons, supplies and materiel.

Today, when every machine must operate around the clock, these strong, flexible, long-life Dayton V-Belts increase output—cut power losses and reduce maintenance time and costs to a negligible minimum. And because Daytons run cool and grip firmly they assure closer speed control.

Built-to-bend Daytons operate on short centers to save precious floor space and permit better location of machines for high-speed production.

For service—or for helpful suggestions regarding the conservation of V-Belts through proper application and maintenance procedure—call the Dayton Distributor who is located nearby to serve your wartime needs. His stock of V-Belts is supplemented by strategically located factory warehouses and his advice or services are yours for the asking.

THE DAYTON RUBBER MFG. CO.
The World's Largest Manufacturer of V-Belts
DAYTON, OHIO

DAYTON RUBBER EXPORT CORPORATION
38 Pearl Street, New York, N. Y. U. S. A.

THROW YOUR SCRAP INTO THE FIGHT!
BUY WAR BONDS AND SAVINGS STAMPS

Dayton V Belts
LIFELINES OF POWER VITAL TO VICTORY

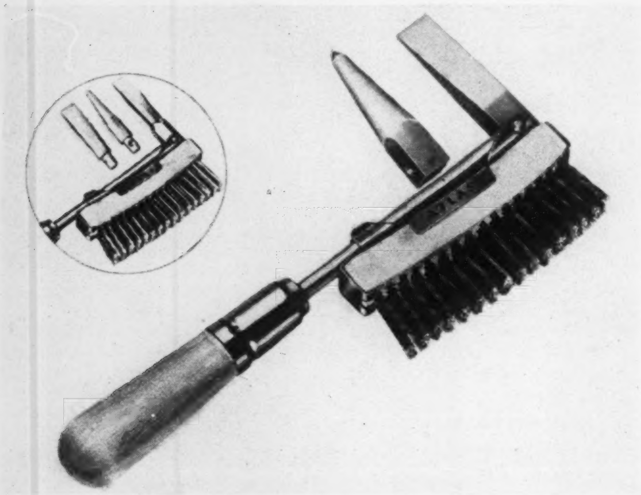
THE GREATEST NAME IN V-BELTS

Copyright 1943, The Dayton Rubber Manufacturing Co.

"Caruso's device has entirely eliminated eye injuries that threw two to four key workers out of production each week," the War Production Fund announced. "It reduced noise from machines employed in the operation by 75 per cent. It has materially contributed to the efficiency and safety of production."—War Production Fund to Conserve Manpower, National Safety Council, Chrysler Bldg., New York, N. Y.

Weld Cleaning Tool

No. 2400**—A new and improved weld cleaning tool for welders in shipyards, aircraft and tank plants, boiler and sheet metal shops, and for oil pipe line, factory maintenance, and general welding work is now being manufactured under the trade name "Dual-Tool." It combines a wire bristle brush and a slap removing bit in one unit and features a specially developed brush holder which permits removal of the brush for reversing or replacement by inserting a screw driver or other sharp object at the rear end of the holder.



Every part of the tool is replaceable, and there is a complete line of replacement parts, including interchangeable cones and chisel bits.—Atlas Welding Accessories Co., 307 Boulevard Bldg., Detroit, Mich.

Vibration Engineering

No. 2401—"Detectives of flutter," they call them. They are tiny electric ears weighing no more than 2 oz. but they have saved many a test pilot's life, many a million of dollars and man-hours tied up in the prototypes of new planes. They do it by running down to its various lurking places that most deadly of aeronautical mysteries—flutter. Flutter, in engineer's language, is "a peculiar resonant condition of surfaces wherein aerodynamic energy is absorbed by the structure, resulting in larger and larger amplitudes of displacement until structural failure occurs." In other words, flutter is a vibration which increases in amplitude until such parts as wings or tail surfaces actually tear off in the air.

To solve the problem, Glenn L. Martin Co. engineers set up a department new to aircraft plants—a vibration department. The group was charged with the task of tracking flutter into its secret and innermost lairs.

FOR LOW-COST HEATING, QUICK INSTALLATION
AND METAL CONSERVATION

DIRECTHERM
UNIT HEATERS
STOKER-FIRED

It is a self-contained unit and can be installed or moved in a few hours. No duct work, radiators, or pipes are necessary.

To tend a Directherm requires a minimum of attention. Once the automatic controls are set, they need not be changed. An unskilled man can take care of it . . . important in these days of labor shortage.

Made in 6 sizes (300,000-1,700,000 BTU).

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. • ST. LOUIS, MO.

First move was to work out methods and equipment for predicting the imminent approach of flutter before it could actually appear and tear the airplane apart.

Since its founding in 1936, the vibration department has rendered great service in the fight to build planes ever bigger and faster. The vibration engineers expect to be still at that job after the war, when air liners will be larger and faster than anything yet known—and they expect to be busy on the industrial front too.

In buildings housing heavy machinery, for example, they will be able to work out the most effective means of isolating the machinery so that it cannot communicate its unpleasant rumblings and vibrations to the building. This applies to such machinery as large printing presses and to the big blowers often used in air conditioning.—Glenn L. Martin Co., Baltimore, Md.

Useful Information

Velocity Characteristics of Narrow Exhaust Slots

In a paper on Velocity Characteristics of Narrow Exhaust Slots, by Leslie Silverman, of the department of industrial hygiene, Harvard School of Public Health, published in the November, 1942, Journal of Industrial Hygiene and Toxicology [see also errata in December issue], a study of a series of unflanged and flanged slots, which was made in order to determine the effect of size on their centerline velocity characteristics, was reported.

In the case of unflanged slots it was found that for slot width to length ratios of 0.2 or less, the centerline velocity was represented by $V = 38.9\,Q/xL$. The velocity varies inversely with distance, which agrees well with theoretical considerations.

For flanged slots, the width to length ratio was more critical. As the value w/L increased above 0.15, the velocity distance exponent was found to increase. For values less than 0.15 the centerline velocity is represented by $V_f = 55.4\,Q/xL$.

The effect of width on flanged slots is negligible, which checks observations previously made on flanged tanks. The velocity varies inversely with distance, which agrees with theoretical considerations.

On the basis of this study it appears that for unobstructed plain or flanged slots the velocity varies inversely with distance and slot length, and slot width is of no importance.

For special slots simulating a tank wall or a wall and base, an approximate value may be arrived at by assuming the velocity to lie halfway between a plain and a flanged slot.

Note: V = Velocity at any distance from hood, fpm; Q = Quantity of air, cfm; x = Distance from opening, inches; w = Slot width, inches; L = Slot length, inches; f = Subscript denoting flanged conditions.

Centerline Velocity Characteristics of Round Openings Under Suction

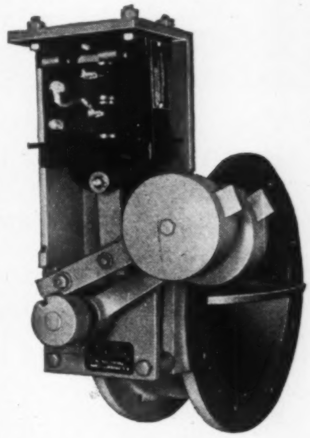
In a paper on Centerline Velocity Characteristics of Round Openings Under Suction, by Leslie Silverman, of the department of industrial hygiene, Harvard School

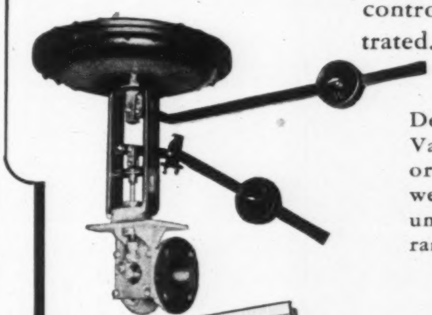
Emergency FIRE FIGHTERS

The operating solenoid in this assembly of an R-S Butterfly Valve connects to the valve vane through a counterweighted lever and latch. The solenoid can be arranged with the mechanism to open or close the valve and hold it there in one position or the other. Failure in the current to the solenoid for any reason results in tripping the latch and permits the counter weight to close or open the valve by gravity. The assembly is suited for emergency use to shut-off flow wedge-tight or to open a vent. Used on sprinkler and foam systems, tank discharge, gas lines and for electrically driven blower protection.

Valve can be constructed of any alloy and in various sizes for air, gases, steam, oil, hydraulic and other services. Resetting is accomplished by hand.

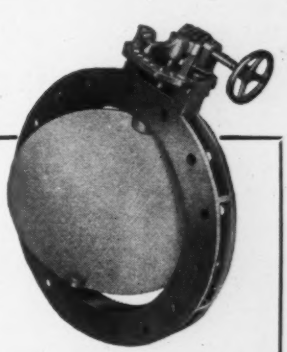
A similar type trip valve can be controlled by pressure as illustrated.


PAT. APPLIED FOR


Depend on R-S Butterfly Valves for low-cost, manual or automatic control and wedge-tight shut-off of volume and pressure. Sizes range from 2 to 84 inches.

15 to 900 P. S. I.

R-S BUTTERFLY VALVES


Wafer (narrow face to face) valves are suitable for pressures up to fifteen pounds. They are light in weight yet high in regulating efficiency.

Write for Catalog No. 10-B.

BUTTERFLY VALVE DIVISION
R-S PRODUCTS CORPORATION
132 Berkley Street • Philadelphia, Penna.

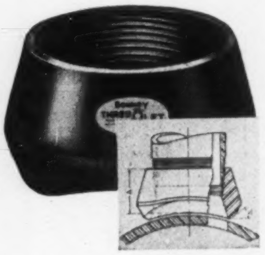
R-S QUALITY PRODUCTS SINCE 1908

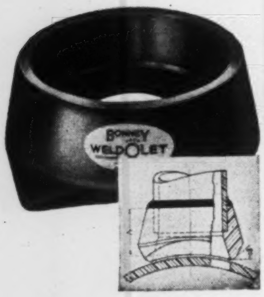
R-S Streamlined

Fittings for all welded right-angle branch pipe outlets

WELDOLETS
for welded branch connections.

THREDOLETS
for threaded branch connections.





SOCKET-END WELDOLETS
for socket-type, welded branch connections.

15 ADVANTAGES

1. Suitable for every piping installation—new construction or maintenance.
2. All templets and preliminary layouts eliminated.
3. Cutting, threading and forming of main line eliminated.
4. Flow conditions improved—turbulence and friction reduced.
5. Installed in 6 easy steps by welder of average experience.
6. Interior of outlet open for inspection after installation.
7. Provide leakproof junctions of full pipe strength.
8. Suitable for all ordinary pressures and temperatures.
9. May be installed before or after erection of main line.
10. Need of braces or supports at junction to care for bending and vibrational stresses eliminated.
11. Reduce cost of branch pipe take-offs.
12. Adapted to pre-fabricated installations.
13. Stock sizes for all pipe up to 12"—on special order to 24".
14. Standard fittings are drop forged steel—wrought iron, Toncan Iron, Monel, Everdur, brass, nickel, etc. on special order.
15. Installed by electric-arc or oxy-acetylene welding.

Bulletin WT31 gives all advantages in detail, complete tables of dimensions and specifications. Write for your copy — TODAY.

Bonney Forge & Tool Works,
Forged Fittings Division,
Allentown, Pa.

WELDOLETS·
TRADE MARKS REG. U. S. PAT. OFF.
THREDOLETS

of Public Health, published in the Novembe , 19 Journal of Industrial Hygiene and Toxicology an vestigation of a complete series of unflanged openin from 2 to 20 in. in diameter, which was made to de mine their centerline velocity equations, was repor The data found were compared to DallaValle's previ work. The new values differ from DallaValle's due the greater range of distances explored and to si covered as well as to the use of an instrument of m sensitivity and accuracy.

A nondimensional type of equation was found to g a close fit. For practical application the modified equ tion

$$V = \frac{Q}{4.45x^2 + A}$$

is recommended. For flanged hoods the approxim equation

$$V = \frac{Q}{3.1x^2 + A}$$

was found to fit the plotted data.

Limitations of these equations and of the nondime sional equation were explained. All equations are su ject to error at distances within 1 in. of the openi and at distances where room eddy currents can inf ence the velocity contours.

Note: V = point velocity, fpm; Q = quantity of a cfm; A = area of opening, square inches; x = distan from opening, inches.

Psychrometric Chart That Is Easy to Read

By Elmer G. Smith, Professor of Physics, Agricultural a Mechanical College of Texas

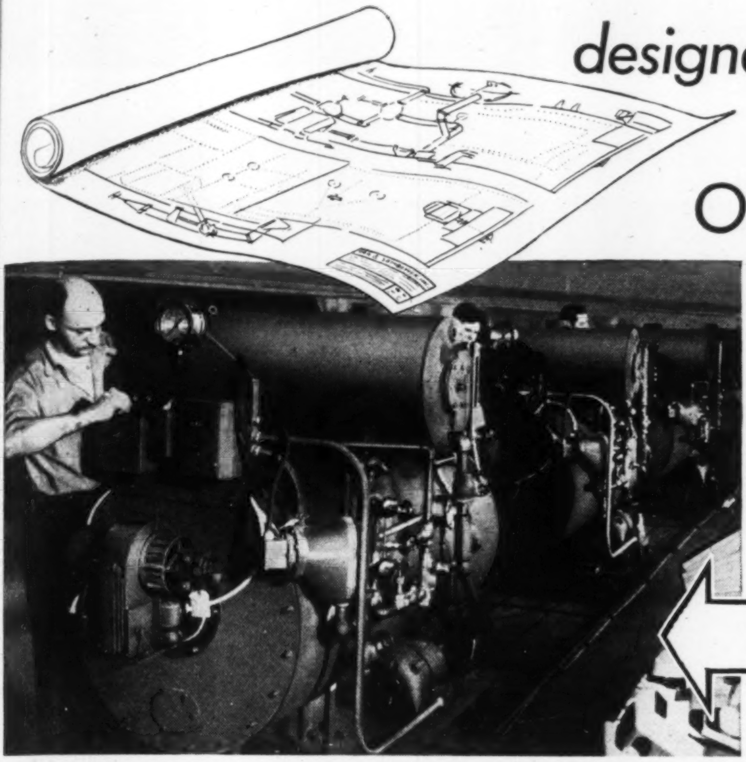
In the November, 1935, issue of Refrigerating Eng neering, F. O. Urban, who was then in the air cond tioning department of the General Electric Co., pu lished a paper entitled A New Psychrometric Chart— Its Construction and Use. This chart is well liked a widely used.

In the past, all charts that coordinate more than t or three variables have been hard to read for so processes and some engineers prefer the slower proce of using tables in order to avoid the eyestrain th sometimes results from using a chart. Probably cause the horizontal and vertical lines are straight a fairly easy to read by means of a straight edge, t inclined lines on the G-E chart were made heavier that they can be read without difficulty.

In a revised edition of this chart, the heavy incli lines have been retained, and in addition a narrow spa on each side of every fifth horizontal and vertical li has been lightly shaded. This makes it possible to fo low the horizontal lines easily without a straight edg and does not interfere with the following of the incline lines.

The chart, revised at the suggestion of the autho has already been used sufficiently to satisfy those wh have had experience with it that it is definitely easi to use than its predecessor. Eyestrain is also reduce and reading speed increased. It is therefore hoped th it may prove to be a real help to a large number of e gineers who work in this field.

The same principle that was used to make this cha



designed for the U. S. Army
by
O&S ENGINEERS

New O & S 15 H. P. BOILER

Rolling off the assembly line in a seemingly endless stream—these newly-developed O & S boilers are already seeing service as a vital part of Uncle Sam's mobile laundry units. Orr & Sembower's engineers designed the compact, sturdy boiler to stiff Army specifications—gave it several revolutionary features . . .

★ 100 lbs. pressure from 60° water in 20 minutes!
★ Fully-automatic control!
★ Weight complete — 2100 lbs.!

Although developed expressly for mobile use in Army laundry units, it promises wide application in your industry when Victory makes O & S Boilers again available for all purposes.

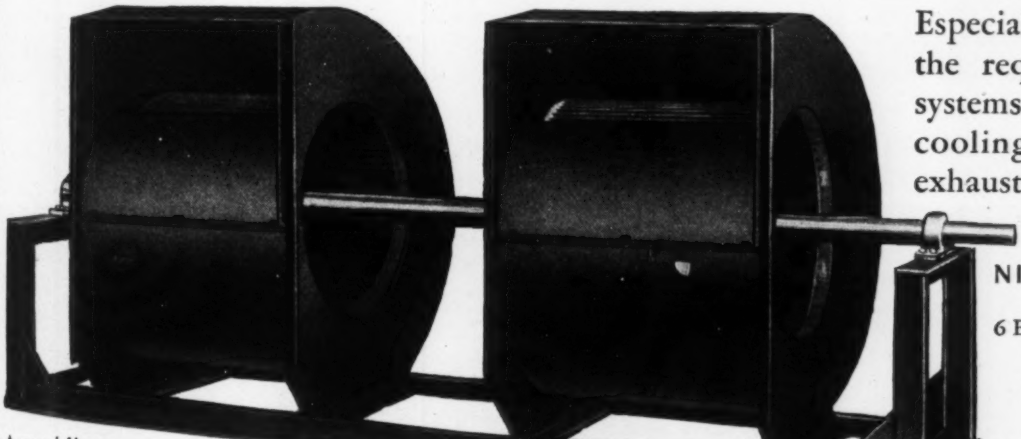
ORR & SEMBOWER INC. O&S
READING • PENNSYLVANIA

Builders of Better Boilers
Since 1885

NIAGARA *Industrial* MOTOR BLOWERS

for VENTILATING, DRYING, EXHAUSTING FUMES *and* LIGHT DUST, HEATING, COOLING, RE-CIRCULATING

Especially designed to meet the requirements of duct systems in blast heating or cooling or in industrial exhaust systems.



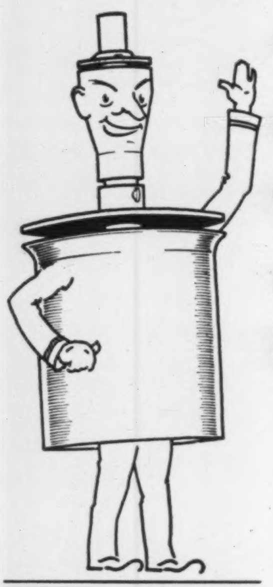
Assemblies of 1, 2 and 3 fans; 16 Models, belt driven or direct connected with and without casings. Two series of fans for highest air capacity—up to 4" S. P.

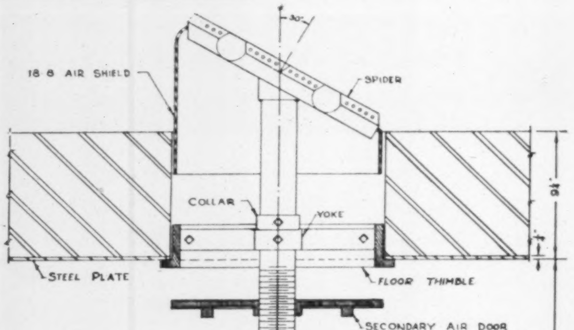
Write for Bulletin 89

NIAGARA BLOWER CO.
Dept. HP-23
6 E. 45th St. New York City
37 W. Van Buren Street, Chicago, Illinois
Fourth & Cherry Bldg., Seattle, Wash.
673 Ontario Street, Buffalo, New York

District Engineers In Principal Cities

NIAGARA INDUSTRIAL COOLING • HEATING • DRYING
HUMIDIFYING • AIR ENGINEERING EQUIPMENT





"JOHN ZINK again does something startling in the development of BURNERS"

JOHN ZINK BI-MIX DIRECTIONAL HEAT BURNER

Can be furnished as gas burner only or as combination oil and gas burner. ADJUSTABLE—the operator can turn the burner to place the heat where desired.

Write for Details Now!

John Zink Co.

TULSA, OKLAHOMA

New York • Los Angeles • Detroit • San Francisco

easier to read can also be applied to various other types of charts where inclined lines as well as horizontal and vertical lines must be read. This principle may be summarized by the statement that the eye should be guided in some directions by making certain selected lines heavier than others of the same group, while in other directions the eye should be guided by lightly shading certain selected spaces.

It is important that the shading be very light. If the shading is too heavy, the following of other groups of lines may not be as easy as it should. In the case of very complicated charts, it may be found possible to use intermittent shading for additional directions. The intermittent shading could be dash-dash, dash-dot, or dot-dot. Shading of variable width can also be used. For example, the width of the shaded space might vary in such a manner that it would just fit between two sine curves or any other arbitrary contours.

Copies of the new chart may be obtained on request to the Manual Service Section, Air Conditioning & Commercial Refrigeration Dept., General Electric Co., Bloomfield, N. J.

Arc Welding Machine and Electrode Standards

The National Electrical Manufacturers Association, 155 E. 44th St., New York, N. Y., has announced the release of a new publication, Electric Arc Welding Machine and Electrode Standards, publication No. 42-81, superseding No. 36-37 on the same subject, which was issued in 1936.

This handbook constitutes a complete revision, the new material covering standards for both d-c and a-c arc welders. The standards for rectifier arc welder equipment remain much the same.

The changes and additions to the d-c welder section cover service conditions, motor starting and generator control equipment, current ratings and current adjustments of multiple operator welding circuit control panels, and resistors and reactors for use with these panels.

Changes in or additions to the a-c welder section include temperature rise, range of operation, current adjustment, short circuit current, control apparatus, panels, terminals, housing, and dielectric tests.

The standards for electrodes have been segregated and to them has been added a table for two-color markings for heavy coated ferrous electrode identification.

The price of this publication is 75c.

Study of Atmospheric Pollution

The October, 1942, Monthly Weather Review, which was just recently published, features a study of atmospheric pollution by W. F. Davidson, research engineer, Consolidated Edison Co. of New York, Inc. A feature of the paper is a chart showing the dust spectrum.

The paper discusses and presents results of a survey taken to determine the extent to which dust emitted from chimneys of power houses and gas manufacturing plants within the city contributed to the general atmospheric pollution of the city.

Single copies of the Monthly Weather Review are available from the Superintendent of Documents, Washington, D. C., for 20c.

Alien Property Custodian Offers Enemy Patents to American Industry

The United States government, through the Office of Alien Property Custodian, now holds about 50,000 patents formerly owned by residents of enemy and enemy occupied countries. The inventions disclosed in these patents represent research achievements of great potential value.

These patents are offered for use by American industry. They should have high usefulness as a means toward winning the war and as a contribution toward rebuilding our peacetime economy. The success of this program will depend largely upon how rapidly and effectively American business utilizes the inventions covered by these patents for increased and improved production.

The Alien Property Custodian has prepared a pamphlet, entitled Patents at Work, to provide American industry with a brief outline of the policies which have been adopted for the administration of these patent holdings. There is also available an index to the classified lists of vested patents for use as a guide in ordering specific sections.

The following listings have been taken from this index; there are many others, these being only the ones of particular interest to HPAC's readers. The numbers shown are the class numbers.

To obtain classified lists of patents and patent applications, write the Office of Alien Property Custodian, Chicago, for classified lists of vested patents and patent applications. All classes are sold for 10 cents each, except Patent Office classes 23, 74, 88, 95, 123, 178, 179, 250, and 260, which are 25 cents each. A complete catalog, without binders, costs $5. Printed copies of vested patents and drawings and specifications of vested patent applications may be secured from the Commissioner of Patents, Washington, D. C., for 10 cents each.

Acoustics, No. 181.
Agitating, No. 259.
Automatic temperature and humidity regulation, No. 236.
Boring and drilling, No. 77.
Classifying, separating, and assorting solids, No. 209.
Clutches and power stop control, No. 192.
Coating processes: and mis. products, No. 117.
Compositions, coating or plastic, No. 106.
Conveyers, fluid current, No. 302.
Drying and gas or vapor contact with solids, No. 34.
Electric heating, No. 219.
Electricity—general applications, No. 175.
Fluid pressure regulators, No. 50.
Fluid sprinkling, spraying, and diffusing, No. 299.
Fuel and igniting devices, No. 44.
Furnaces, No. 110.
Gas and liquid contact apparatus, No. 261.
Gas, heating and illuminating, No. 48.
Gas pumps and fans, No. 230.
Heat exchange, No. 257.
Heating, No. 263.
Heating systems, No. 237.
Liquid and gaseous fuel burners, No. 158.
Liquid heaters and vaporizers, No. 122.

MERIAM

CLEAN-OUT MANOMETER

Quickly and Easily
CLEANED WITHOUT DISCONNECTING

This U-Type Clean-Out Manometer is for checking gas and air pressures from a few ounces up to several pounds. Suitable for either portable service or permanent installation.

The head is quickly removed—with a few turns of the wing nut—permitting quick cleaning of tube, with brush furnished. This feature also adds to its portability. It also allows convenient changing of the indicating fluid (oil, water or mercury).

This Clean-Out Manometer is available in standard ranges from 6″ to 50″. One of many instruments made by us throughout the past 32 years. Ask for Bulletin 1.

THE MERIAM CO.
Since 1911
1985 West 112th St., Cleveland, O.

MERIAM
SINCE 1911
★
MANOMETERS, METERS AND GAUGES FOR THE ACCURATE MEASUREMENT OF PRESSURES, VACUUMS AND FLOWS OF LIQUIDS AND GASES

FILTER BANKS—Send for New Technical Data Sheets on Research Air Filter Banks—FREE!

Triple Filter Life!

Save Vital Materials with

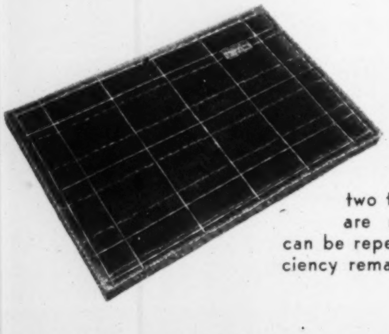
RiP-CLEAN Air Filters

RiP CLEAN
RESEARCH PRODUCTS CORPORATION MADISON
RESEARCH PRODUCTS CORP.
RP
MADISON, WIS.
REG. U.S. PAT. OFF.

Less Restriction—Greater Capacity—More Efficient . . .

RESEARCH AIR FILTER

Here's the filter that has been adopted by leading manufacturers as standard equipment in air conditioning and forced air heating systems . . . in homes, office buildings, factories, stores, theatres, streamline trains. Best for industrial dust removal, central air conditioning, ventilating systems, furnaces, unit air conditioners, paint spray booths and air intakes on diesels and air compressors.



The No. "200 Series"

The RiP-Clean filter with the self-seal edge. When filter becomes clogged the two top layers of filter pad are rolled off . . . this can be repeated 5 times, the efficiency remaining uniform.

RESEARCH PRODUCTS CORP.
MADISON, WISCONSIN

RESEARCH PRODUCTS CORPORATION
1017 East Washington Ave.
Madison, Wisconsin

Please send us your newly published Filter Bank technical data sheets (Form 715); this information will be sent without any obligation.

Signed ....

Liquid separation or purification, No. 210.
Measuring and testing, No. 73.
Metal bending, No. 153.
Metal drawing, No. 205.
Metal forging and welding, No. 78.
Metal founding, No. 22.
Metal rolling, No. 80.
Metal tools and implements, making, No. 76.
Metal treatment, No. 148.
Metal working, No. 29.
Motors, No. 185.
Multiple valves, No. 277.
Pipe joints or couplings, No. 285.
Pipes and tubular conduits, No. 138.
Plastics, No. 18.
Pumps, No. 103.
Radiant energy, No. 250.
Refrigeration, No. 62.
Registers, No. 235.
Sheet metal ware, making, No. 113.
Signals and indicators, No. 116.
Spring devices, No. 267.
Stoves and furnaces, No. 126.
Thermostats and humidistats, No. 297.
Valved pipe joints or couplings, No. 284.
Valves, No. 251.
Ventilation, No. 98.

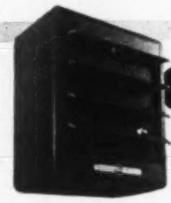
The Alien Property Custodian today controls the largest block of patents in the United States. They number in the tens of thousands. They cover inventions in every field of applied science and represent millions of man hours of research and the expenditure of many millions of dollars. These inventions represent some of the finest foreign research achievements in modern science, particularly in the production of dyestuffs, plastics, pharmaceuticals, and electrical goods. Other important United States patents vested in the Alien Property Custodian include those relating to synthetic shellac manufacture, waterproofing of cloth, quick freezing of fruit juices, improved magnetic alloys, and processes for making rayon. Here are many patents covering processes which have given the axis nations the ability to carry on mechanized warfare for years while cut off from sufficient supplies of basic raw materials, from petroleum, rubber, certain nonferrous and alloy metals, sugar, cotton, and wool.

Already, enterprising Americans have received licenses from the Alien Property Custodian and put to work patents formerly owned by the enemy. Such licenses relate to chemical warfare, mining machinery, hydraulic presses to stretch metal airplane parts, the production of sulfur from "sour gas" from oil wells, hoisting cranes, automatic textile winding machinery, the manufacture of acetylene from natural gas, food processing, rust and corrosion inhibitors, the manufacture of phenol, and many other products and processes. We now have better goods than before; critical materials have been saved and manpower spared, according to the Alien Property Custodian.

Acting under the authority of the trading with the enemy act, as amended by the first war powers act of

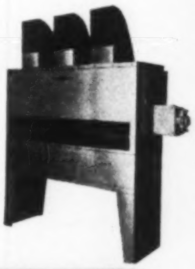
For Army-Navy Projects and War Industries

At this time The Herman Nelson Corporation is busy furnishing Heating, Ventilating and Air Conditioning Equipment for use everywhere in connection with work vital to our National War Effort. However, The Herman Nelson Corporation is maintaining Sales and Service Offices in all Principal Cities in order to help facilitate war work. Each office is equipped to quote and aid in working out details for your war project.

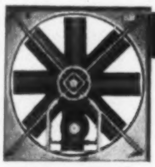


HERMAN NELSON hijet HEATERS

Horizontal Shaft Propeller-Fan Type hijet Heater projects warm air downward in the desired direction. Eliminates waste fuel and space. Available in 48 models, sizes and arrangements.

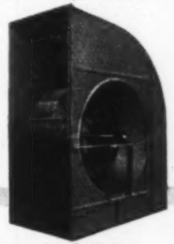


Herman Nelson Blower-Fan Type hijet Heater provides efficient heating of large areas. Streamline discharge outlets maintain large air delivery with high velocity. For floor, wall, ceiling, or inverted wall mounting. Available in 150 models, sizes and arrangements with a wide range of capacities.



AUTOVENT FANS AND BLOWERS

Autovent Propeller Fan. Exclusive Autovent design—direct or belt driven. Ruggedly constructed for economical operation under severe conditions. Available in wheel diameters from 9 to 54 inches; capacities 450 to 26,000 cfm



Autovent Blower for heavy duty ventilating and air conditioning installations. This Blower can be furnished to any speed or discharge requirements, in a wide range of sizes.

Sales and Service Offices in Following Principal Cities

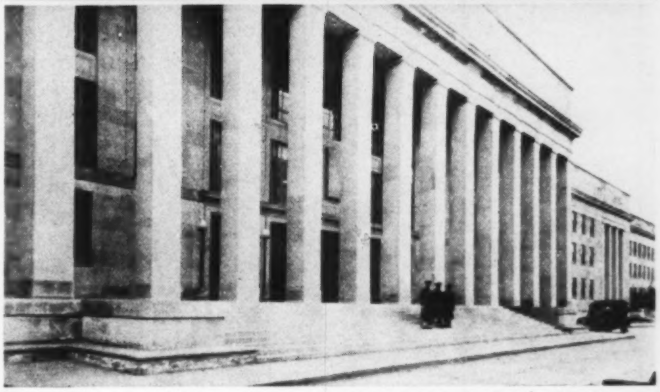
Albuquerque, N. Mex.
Atlanta, Ga.
Baltimore, Md.
Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Charlotte, N. C.
Chicago, Ill.
Cincinnati, Ohio
Cleveland, Ohio
Columbus, Ohio
Dallas, Texas
Denver, Colo.
El Paso, Texas
Emporia, Kans.
Fort Wayne, Ind.
Grand Rapids, Mich.
Houston, Texas
Indianapolis, Ind.
Jackson, Miss.
Johnstown, Pa.
Kansas City, Mo.
Los Angeles, Calif.
Louisville, Ky.
Madison, Wis.
Memphis, Tenn.
Miami, Fla.
Milwaukee, Wis.
Minneapolis, Minn.
Missoula, Mont.
Moline, Ill.
Nashville, Tenn.
New Orleans, La.
New York City, N. Y.
Norfolk, Va.
Omaha, Neb.
Philadelphia, Pa.
Pittsburgh, Pa.
Portland, Maine
Richmond, Va.
Saginaw, Mich.
Salt Lake City, Utah
San Antonio, Texas
San Francisco, Calif.
Scranton, Pa.
Seattle, Wash.
Spokane, Wash.
St. Louis, Mo.
Syracuse, N. Y.
Tucson, Ariz.
Tulsa, Okla.
Washington, D. C.
Watervliet, N. Y.
Westfield, Mass.

THE HERMAN NELSON CORPORATION, MOLINE, ILLINOIS

Autovent Fan & Blower Division, Chicago, Illinois
Manufacturers of Quality Heating, Ventilating and Air Conditioning Products

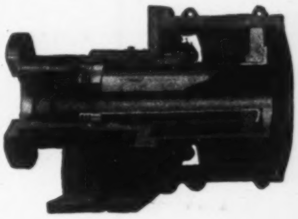
ADSCO PISTON-RING EXPANSION JOINT

INSTALLED IN THE NEW PENTAGON BUILDING



Charles S. Leopold, Mechanical Engineer
Baker Smith & Co., Mehring and Hanson, Heating Contractors

Fully guided internally and externally. Available in single or double joints for high pressure and high temperatures; flanged or beveled ends.



ONLY SLIP-TYPE JOINTS THAT MAY BE UNPACKED AND REPACKED UNDER PRESSURE

- Of all places where costly line shut downs must be avoided, Washington's big, busy Pentagon Building is a typical example.

That's why here you'll find ADSCO Piston-Ring Expansion Joints. Only slip-type joints of their kind that can be unpacked and repacked under pressure, thereby eliminating interruptions to service.

FOR VICTORY
BUY UNITED STATES WAR BONDS AND STAMPS

For steam, hot water, oil or gas lines, specify this modern expansion joint that is always on the job. Write for bulletin 35-15HP.

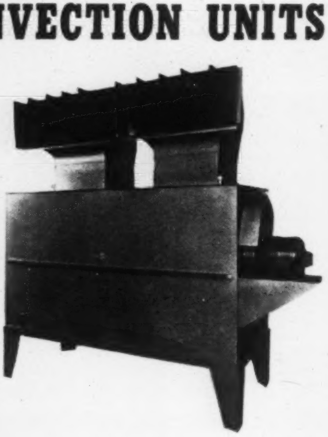
AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, NEW YORK
Makers of "UP-TO-DATE" Steam Line Equipment For Over 60 Years

Refrigeration &
Air Conditioning
Equipment

ACME
PRODUCTS
★★★

24 Years' Continuous Service
to the industry

FORCED CONVECTION UNITS



DRY, WATER DEFROST
CONTINUOUS BRINE
SPRAY

FINNED AND PLAIN
SURFACE COOLING COILS

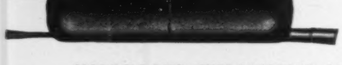
HIGH AND LOW
TEMPERATURE UNITS

FLOOR AND CEILING
MODELS FOR EVERY
REQUIREMENT

For complete information
Write for
Catalog No. 32

HEAT EXCHANGERS

SUCTION LINE



CAPACITIES
1 TON TO 180 TONS

INCREASES EXPANSION VALVE CAPACITY

Prevents line vibration and chattering valves

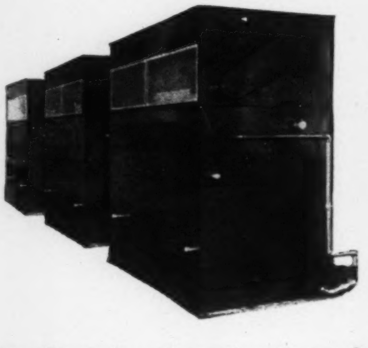
OFTEN INCREASES COMPRESSOR CAPACITY

Prevents liquid return to compressor. Eliminates suction line sweating

Larger models built with U Tube removable bundles

CATALOG NO. 12

EVAPORATIVE CONDENSERS



SAVE 85% TO 90%
ON COST OF WATER

ELIMINATE WATER
DISPOSAL PROBLEM

AUTOMATIC FLOAT
VALVE CONTROLS
WATER SUPPLY

CAPACITIES TO MEET
EVERY INSTALLATION
NEED

CATALOG No. 27

May our Engineering Dept. be of service to you?

ACME INDUSTRIES

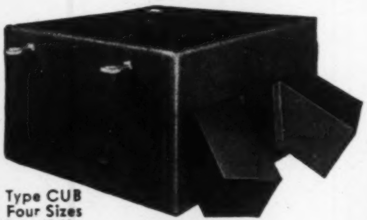
JACKSON • MICHIGAN

December 18, 1941, the President established the Office of Alien Property Custodian in March, 1942 (executive order No. 9095 of March 11, 1942, as amended by executive order No. 9193 of July 6, 1942). This office is one of the emergency war agencies of our government and, like most of the others, it is organized within the Office for Emergency Management of the executive office of the President.

The Alien Property Custodian has the function of taking title to or controlling property in the United States which is owned or controlled by enemy nationals or, in certain cases, by non-enemy foreign nationals. Such property includes business enterprises of all kinds and sizes, real property, trusts, estates, ships, patents, copyrights, trademarks, and certain miscellaneous property. By direction of the President this office is not taking action with respect to cash, bank deposits, and securities standing in the names of enemy or foreign nationals, where such holdings are not related to foreign owned property of other types. A "foreign national" as used here means, in brief, any person or organization domiciled in a foreign country, as well as a person or organization in the United States controlled by or acting on behalf of, or an organization owned by, such a foreign national. An "enemy national," similarly, means a national of a foreign country with which the United States is at war.

The Office of Alien Property Custodian takes title to or supervision over foreign or enemy property in order to prevent it from being useful to the enemy and in order to administer it in the interest of the United States.

ELECTRIC HEAT
keeps workers on the job

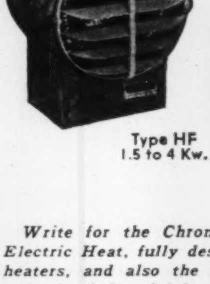


Type CUB
Four Sizes
15 to 40 Kw.

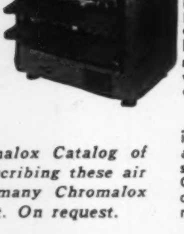
Cut out the cold spots in plant and office—and keep employees healthy, happy and *working.*

Instant heat for overtime workers, even with boilers shut down. Keep up wartime production schedules with

CHROMALOX *Electric* AIR HEATERS



Type UB
2 to 15 Kw.



Type HF
1.5 to 4 Kw.

There are no hard-to-get places for Chromalox heaters. This means the most remote gate house, or moving crane cab • Installation is a matter of minutes—no piping, no leaks, no problems • A quick way to provide heat for new shops or offices • An easy way to relieve overloaded boilers, in mid-winter as well as in spring, when boiler heat may be shut down weeks earlier.

Wide range of types, heating with blower-driven warm air, or by convection. Many sizes, meeting every need. Check with us on operating cost, type and size of units required.

Write for the Chromalox Catalog of Electric Heat, fully describing these air heaters, and also the many Chromalox units for industrial heat. On request.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

Advantages of Air Conditioned Submarine Described by Foreign Correspondent

The following paragraphs have been taken, with permission, from a dispatch by B. J. M'Quaid of the Chicago Daily News Foreign Service which appeared in the News last month:

"The sub gets under way for a surface run to the testing area and the engineering officer invites you to tour the ship. In the engine room, a big diesel is already roaring so as to make conversation impossible. Shouting and gesticulating, he invites you to follow him down the hatch to the compartment below the engine room to view the powerful compressors of the air conditioning system that is a unique feature of the long range American subs.

Aids Fighting Efficiency

"Back in peacetime, foreign critics called this a sissy business, and an indication that the American submarine navy was soft and excessively comfort-loving. In this war, sub air conditioning has proved of value not only as a factor in the physical well being of the crews, but as an aid to the fighting efficiency of the subs themselves. It absorbs vast amounts of moisture that build up in a sub during enforced long hours of submergence and thus keeps down the humidity and reduces to a minimum the electrical grounds otherwise bound to occur in instruments possessing the myriad electrical leads of a sub's machinery."

New ECONOMY PUMPS

For Clear Liquid Service 10 to 500 GPM

The ECONOMY SCV line of precision built, efficient, quiet, durable pumps, assure years of trouble-free operation on circulating lines. Especially adapted to air conditioning systems, cold or hot water circulation, brine circulation, sprinkler systems, boiler feeding, pressure boosting, etc. They do their given tasks with utmost efficiency and greatest economy. Vertical construction saves floor space . . . keeps motor above floor level and free from dirt and water. Send for FREE 256 page Handbook on Pumping Problems and solutions and for Catalog D2-1042 which completely describes the new SCV pumps.

ECONOMY PUMPS, INC.
1011 WELLER AVENUE HAMILTON, OHIO

PETRO
REG. U. S. PAT. OFF

OIL BURNING SYSTEMS

are only available—"for duration," on orders carrying high preference ratings.

BUT—

Petro service, parts for necessary maintenance, and engineering consultation and services, are still fully available.

AND—

hundreds of Petro Oil Burning Systems are meeting unprecedented steam demands in war production plants everywhere;

—24 hour operation, far above normal ratings, day after day, week after week;

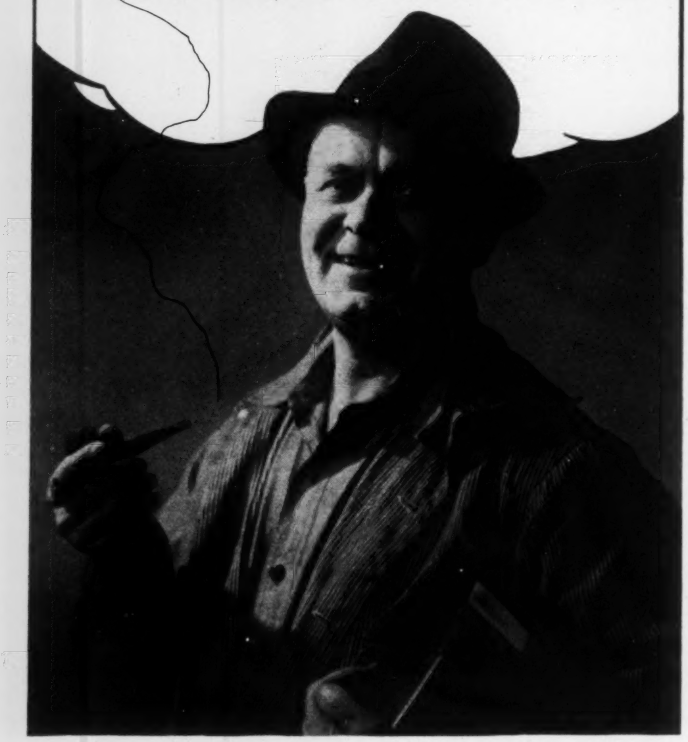
—a "break down" test on a gigantic scale which Petro equipment is meeting efficiently, economically, reliably, and without breaking down because ample reserve strength and wear has always been built into Petro.

In addition to being proud of such performance, we think it is a good thing for the heating trade to remember against the time when conditions again permit the free selection and installation of normal industrial and commercial firing equipment.

OIL IS AMMUNITION USE IT WISELY

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD — CONNECTICUT

KEEPING JOE
WARM IS YOUR
IMPORTANT JOB

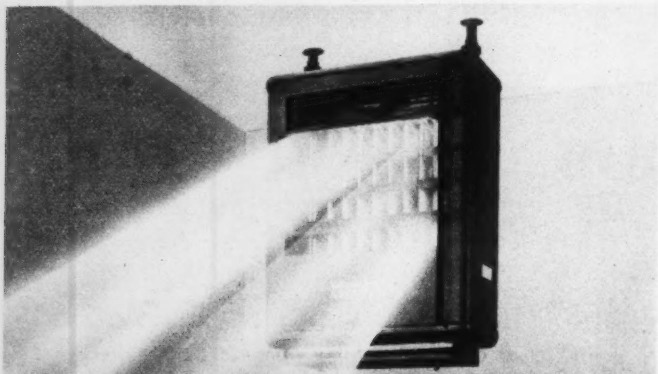


REZNOR Unit Heaters Will Do It

When properly located, Reznor Suspended Gas Fired Unit Heaters will heat an entire manufacturing plant economically—no cold, forgotten corners—every employee works where temperatures are RIGHT. Furthermore, the Reznor system may be installed in less time . . . saving man hours . . . requiring 89% less of vital materials . . . and reducing installation costs.

Write for complete catalog today.

Reznor Mfg. Co., 305 James St., Mercer, Penna.



"GAS HEATERS EXCLUSIVELY SINCE 1888"

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 91. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to HEATING, PIPING & AIR CONDITIONING.

Arc Welding Accessories for Women

No. 4366—12 p. bulletin (GEA-3295) presenting complete line of safety clothing and equipment specially designed for girl welding operators.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Centrifugal Pump Care in Wartime

No. 4367—28 p. handbook for wartime care of centrifugal pumps comprising a maintenance guide with specific recommendations for putting pump care on a wartime basis. Pertaining to all makes of pumps and containing no advertising, the booklet is well illustrated, interestingly written, with a discussion of pumps, how they operate, and piping connections. It has a section on how to locate trouble and what to do about it.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Copper and Brass Weights and Data

No. 4368—Sixth edition of Weights and Data handbook with a new section giving technical and mill defini-

X-PANDO PIPE JOINT COMPOUND

WITHSTANDS—
DEFLECTION
VIBRATION
EXTREME
TEMPERATURE
CHANGES

EXPANDS AS IT SETS

One formula for all uses—corrects imperfections in threads—smooths flange faces—expands and contracts with pipe movement — withstands pressure—holds anything carried in metal pipe except some heavy acids —economical, goes four to six times further than ordinary compounds —ends leaks permanently in all types of lines.

Distributors Everywhere • Ask Your Local Mill Supply House

X-PANDO
EXPANDS AS IT SETS

X-PANDO CORPORATION
43-15 36th Street, Long Island City, New York

Canadian Distributors: La Salle Products Ltd.,
159 Jean Taylor St. W., Montreal, Quebec, Canada

tions of terms used in the copper and brass industry, and with complete information on chemical and physical properties, formulas, conversion factors, and much other fundamental information. — Revere Copper and Brass Incorporated, 230 Park Ave., New York, N. Y.

Industrial Thermometers

No. 4369—Series of five bulletins (G23-2, G503-2, G603-2, G403-2, G303-3) describing complete line of industrial indicating, recording and control thermometers. The first of the bulletins, entitled Thermometer Data, discusses operating principles and gives information to aid the user in selecting the proper instrument. —Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill.

Insulation

No. 4370—36 p. bulletin on "Insul-Mastic" waterproofing and rustproofing insulation for use in industry, describing the types, their applications, properties, and including test and service records.—Insul-Mastic Corp. of America, Chrysler Bldg., New York, N. Y.

Metal Duplicating Without Dies

No. 4371—32 p. catalog (43-4) describing the "Di-Acro" system of metal duplicating without dies. An improved shear is illustrated and specified and an improved and revamped brake is also covered.—O'Neil-Irwin Mfg. Co., Inc., 316 Eighth Ave., S., Minneapolis, Minn.

NEW ENGLAND
CLEANSING NEW ENGLAND DYEING
OVERALL
NEW ENGLAND
CLEANSING DYEING

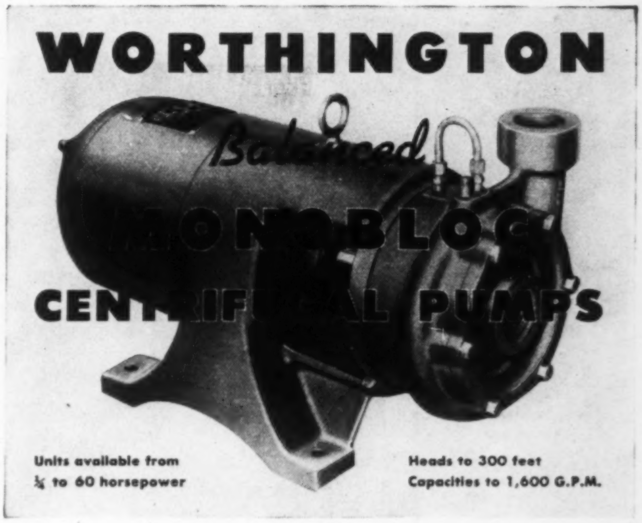
THE HURRICANE
BLEW IT OFF *but*
2 FLOORS NOW DO THE WORK OF THREE WITH
Sarco

The hurricane blew the top floor of the New England Overall Company to the ground. A rearrangement of machines — plus a speed-up produced by all-Sarco steam traps and controls — enabled this company to do more business with two floors than they formerly did with three.

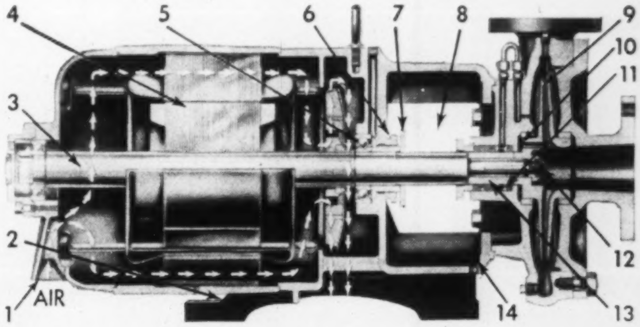
The owner says: "If you have three wash wheels, you should be able to load them up all at the same time. If your plant is full of presses, pants stretchers, tumblers, etc., no one machine should be slowed up by any or all of the others. Our contractors advised a separate Sarco steam trap for each machine — we know now it would have been folly to do it any other way. I know what steam costs and what it costs to have operators wait. I'll spend a dollar to save ten anytime." Catalog No. 350.

145

SARCO
SAVES STEAM
SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
Sarco Canada Ltd., Federal Bldg., Toronto, Ont.



Engineered by Worthington as a single unit . . . pump and motor made for each other . . . the MONOBLOC Centrifugal Pump is an outstanding example of compact dependability. The first requirement of good engineering . . . simplicity of construction . . . assures the user of every Worthington MONOBLOC Pump long, trouble-free and efficient service at *low first cost.*



SAFEGUARDS OF PERFORMANCE

1. Correct distribution of ventilating air for motor
2. Extra-high motor support prevents flooding . . . base-plate unnecessary
3. Extra-large diameter one-piece shaft
4. Drip-proof motor with pyramid base
5. Extra-large shielded bearings
6. Solid front head on motor trough . . . no drips enter bearings
7. Correctly designed Neoprene water slinger
8. Greater accessibility for stuffing box and gland inspection
9. Hand finished and balanced impeller
10. Hydraulic balance relieves pressure on stuffing box . . . reduces thrust
11. Extra-deep stuffing box
12. Special construction of impeller lock nut
13. Shaft sleeve extends through stuffing box
14. Extra strength . . . base, motor-end bell and pump bracket, in one piece

Worthington is the first manufacturer to build a complete line of truly MONOBLOC one-unit pumps.

SEND FOR BULLETIN W-321-B14

CP3-4

WORTHINGTON
WORTHINGTON PUMP & MACHINERY CORPORATION • GENERAL OFFICES: HARRISON, N. J.

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

A SURE CURE

APPLY WITH BRUSH, TROWEL OR SPRAY

NoDrip ● This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance and can be painted any color. A gallon covers about 30 feet of 1" O.D. pipe. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House. Write for **NoDrip Handbook.**

J. W. MORTELL CO.
Technical Coatings Since 1895
512 Burch Street, Kankakee, Illinois

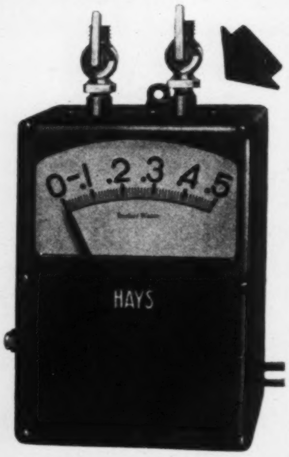
WARNS WHEN AIR-FILTER CLOGS WITH DIRT

DIRT clogged filters in the air circulating system mean reduced efficiency and added power costs. On the other hand, changing filters oftener than necessary represents money wasted.

Install a Hays Air-Filter Gage and know exactly just how dirty and inefficient your filters are. An indicator shows the air resistance at all times. When the resistance becomes excessive an alarm is sounded or signal flashed. A high quality precision instrument by pioneer instrument makers. Write 990 Eighth Avenue, Michigan City, Indiana for special bulletin 37-278.

HAYS AIR-FILTER GAGE

TELLS CONDITION OF FILTER AT ALL TIMES



THE HAYS CORPORATION
SINCE 1901
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

Plastics

No. 4372—64 p. data book on cellulose plastics in war and industry, comprising a manual of specifications, properties, and applications of sheets, rods, tubes, films and foils, molding materials, plasticizers, cements, dopes, and glazing materials.—Celanese Celluloid Corp., 180 Madison Ave., New York, N. Y.

Pneumatic Tools

No. 4373—132 p. catalog (564) of pneumatic tools for industry, presenting and describing a complete line together with accessories.—Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N.Y.

Production for War

No. 4374—Mailing piece featuring the slogan, "We are fighting the AXIS, not each other!" being a reprint of an editorial by Paul K. Addams.—Fitzgibbons Boiler Co., Inc., 101 Park Ave., New York, N. Y.

Refrigeration for Ships

No. 4375—8 p. bulletin (530-A) describing refrigeration equipment and applications for naval and merchant vessels.—Frick Co., Waynesboro, Pa.

Silver

No. 4376—40 p. annual review of the silver market for 1942.—Handy & Harman, 82 Fulton St., New York, N. Y.

Speed Reducers

No. 4377—100 p. bulletin (22-27) on speed reducers in sizes from 1/50 to 10 hp and 0.08 to 1140 rpm.—Janette Mfg. Co., 556 W. Monroe St., Chicago, Ill.

Synchronous Motor Control

No. 4378—12 p. bulletin (GEA-1724D) on synchronous motor control, explaining not only the primary but also the additional functions performed by the various controls.—General Electric Co., 1 River Road, Schenectady, N. Y.

Vibration Isolation

No. 4379—12 p. bulletin on "Vibro-Insulators," describing these devices and their selection, applications, characteristics, etc. Also, a 4 p. engineering work sheet of assistance in compiling the data necessary to attack vibration problems.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Wrought Iron for Underground Services

No. 4380—36 p. technical bulletin on wrought iron for underground services, discussing the factors affecting soil corrosion in underground piping and giving installation histories of water wells and lines, sprinkler piping, oil and gas wells and lines, gasoline lines and tanks, and electrical cable conduit.—A. M. Byers Co., Clark Bldg., Pittsburgh, Pa.

Now we're making it HOT for the AXIS . . .

Quiet May

OIL BURNERS

APECO SAVES MAN HOURS

APECO DOES THE WORK OF 3 PEOPLE IN MY DEPARTMENT

With an APeCO Anyone Can Make Exact Photographic Copies of Blueprints, Letters, Specifications, Orders, Tracings -- Anything Typed, Printed, Drawn or Photographed! Easily and Quickly!

$55 F.O.B. CHICAGO

IMMEDIATE DELIVERY on machines and supplies. Learn how others in your field have SAVED MAN-HOURS while speeding production. Write for time-saving facts.

Any boy or girl can do all your copying work—better, faster, privately—releasing Draftsmen, Clerks, Typists AND THEIR EQUIPMENT for other work.

APECO PHOTO COPIES

are identical copies—clear, sharp, durable — legally accepted. No proofreading! No errors! With APeCO you can make *Photo-tracings* direct from drawings, blueprints or old tracings.

APeCO makes copies any size up to 18x22" 1st copy in 3 minutes, 120 copies an hour—right in your own place—anytime, day or night. *No skill or darkroom needed!* Foolproof! Nothing to get out of order

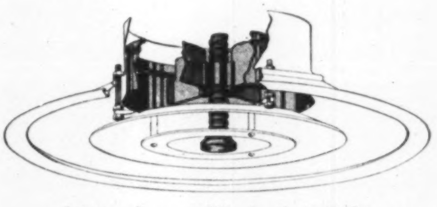
AMERICAN PHOTOCOPY EQUIPMENT CO.
2849 N. Clark St., Dept. CJ-1, Chicago, Ill.
REPRESENTATIVES IN ALL PRINCIPAL CITIES AND CANADA

APECO SPEEDS YOUR PRODUCTION

KNO-DRAFT K-NEWS

AIR VOLUME AT YOUR FINGER TIPS

. . . without the sacrifice of any of the benefits of perfect air diffusion. This is made available through the new KNO-DRAFT* Air Diffuser equipped with Type DEE Air Volume Control.



Cutaway diagram of Kno-Draft Air Diffuser equipped with Type Dee Air Volume Control

Designed to complement the function of the diffuser, it permits varying the air *quantity* without affecting the *characteristics* of the air distribution.

Furnished completely assembled within the diffuser and adjusted — ready to operate.

**Formerly known as Dorex Kno-Draft Air Diffuser*

WB CONNOR ENGINEERING CORP.

W. B. CONNOR ENGINEERING CORP.
114 East 32nd Street New York, N. Y.

GREEN LIGHT FOR INDUSTRY

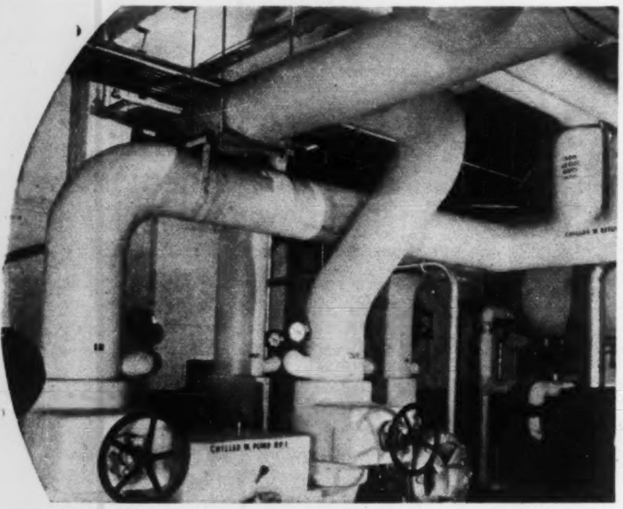
*SARAN PLASTIC PIPE, TUBING, FITTINGS

SARAN by HODGMAN is a tough thermoplastic specially made to replace strategic materials. It is adaptable for use under high working and bursting pressures and is resistant to most chemicals. Its ease of handling makes it extremely valuable in installations requiring the transport of oil, gas and corrosive chemicals.

*Pat. No. 2160931

Send FOR COMPLETE INFORMATION SHEET AND FREE SAMPLE

HODGMAN RUBBER CO.
FRAMINGHAM, MASS.
NEW YORK 261 Fifth Avenue
CHICAGO 412 South Wells St.
SAN FRANCISCO 121 Second St.



Mundet Cork Pipe Covering is made of 100% pure cork, which, due to its low conductivity, holds power costs to the minimum. Its high efficiency permits precise control of low temperature regardless of climate or season • Cold lines, low-temperature ducts, the walls, floors and ceilings of refrigerated rooms should be adequately protected by Mundet Cork Insulation in the form of Cork Pipe Covering and Corkboard • For test data, showing what Mundet Cork Insulation means in savings and operating efficiency, write to Mundet Cork Corporation, Insulation Division, 65 South Eleventh Street, Brooklyn, New York.

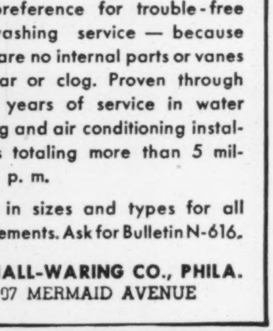
MUNDET CORK INSULATION
CONSERVES LOW TEMPERATURE

YARWAY
INVOLUTE NOZZLES

The preference for trouble-free air washing service — because there are no internal parts or vanes to wear or clog. Proven through many years of service in water cooling and air conditioning installations totaling more than 5 million g. p. m.

Made in sizes and types for all requirements. Ask for Bulletin N-616.

YARNALL-WARING CO., PHILA.
107 MERMAID AVENUE



"NON-METALLIC" REGISTERS
FOR DEFENSE PROJECTS

Approved by Government Authorities for air-conditioning installations in Hospitals, Industrial Plants, Fortifications, etc., under Army, Navy or Maritime rulings. Field-tested STANDFORATED Register and Grille designs of durable, tempered Masonite are fabricated in standard sizes or to your specifications. Write for complete information.

DESIGN NM-SLD—"Non-Metallic" Sliding Damper Foundation Vent.

FOR PRODUCTION SPEED-UP—
Specify Precision Processed STANDFORATED Perforations. Industrial Screens, Filters, Guards, etc., made to specifications for vital industries. Handy catalog sent on request.

STANDFORATED

STANDARD STAMPING & PERFORATING CO.
3151 W. 49th PLACE · CHICAGO, ILLINOIS

Coming Events

Testing Materials

American Society for Testing Materials: Spring meeting and committee week, week of March 1, Hotel Statler, Buffalo, N. Y. Headquarters office of the ASTM is at 260 S. Broad St., Philadelphia, Pa.

Power Conference

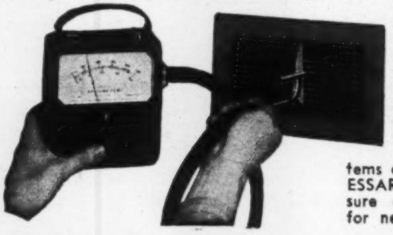
Midwest Power Conference: April 9-10, Palmer House, Chicago, Ill. Sponsored by Illinois Institute of Technology with the cooperation of nine other schools and seven local professional engineering sections. The conference director is Stanton E. Winston, professor of mechanical engineering, Illinois Tech, 3300 Federal St., Chicago, Ill.

Foundry War Production

American Foundrymen's Association: 47th annual meeting, April 28-30, Hotels Jefferson and Statler, St. Louis, Mo. Meeting is to be a "mobilization of management, technical, and operating men for devising ways and means for extending use of cast metals in the war effort." Headquarters office of the AFA is at 222 W. Adams St., Chicago, Ill.

Smoke Prevention

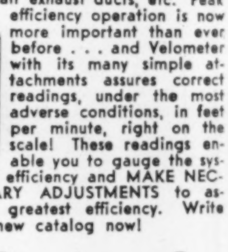
Smoke Prevention Association: 37th annual meeting, June 8-11, Hotel William Penn, Pittsburgh, Pa. Headquarters office, 139 N. Clark St., Chicago, Ill.



"ALNOR" VELOMETER
DIRECT READING AIR VELOCITY METER

"Alnor" Velometer fills the need for a simple, accurate means of determining air velocity in air conditioning, forced air exhaust ducts, etc. Peak efficiency operation is now more important than ever before . . . and Velometer with its many simple attachments assures correct readings, under the most adverse conditions, in feet per minute, right on the scale! These readings enable you to gauge the systems efficiency and MAKE NECESSARY ADJUSTMENTS to assure greatest efficiency. Write for new catalog now!

Don't Guess Know!
Illinois Testing Laboratories Inc.
412 N. La Salle St., Chicago, Ill.



IT'S STILL A DIFFERENT UNIT HEATER

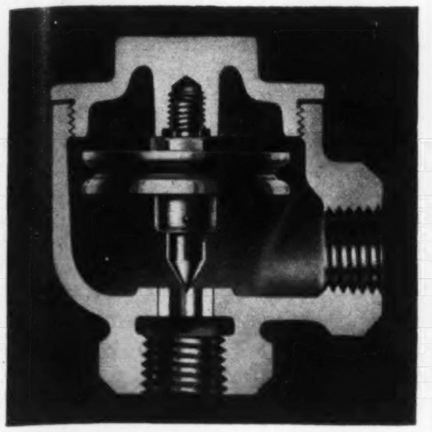
Cast iron takes the place of aluminum for the heating sections, to cooperate with the war effort in using substitute materials—but it's still the ultimate in unit heater quality.

The new Grid is engineered along the same lines as the Grid Unit which had aluminum heating sections — dependable, long life unit. Patent applied for. No corrosion—no leaks or breakdowns . . . In this new Grid Unit there is only one type metal in contact with steam or hot water. There is nothing to cause electrolysis that produces corrosion. Engineered and constructed to withstand up to 250 lb. steam pressure.

NOW made with CAST IRON Heating Sections

D. J. MURRAY MFG. CO.
Wausau, Wis.

GRID UNIT HEATER



"Old Ironsides"
winning war-time service stripes

Here is the record . . . Webster Steam Heating Equipment—using a minimum of critical metals and limited to essential sizes and models—is maintaining a 50-year record of superior heating results.

Chances are that you were a boy in short pants when Warren Webster pioneered the principles of modern steam heating. Since that time more than five million Webster Radiator Traps have been installed with this remarkable record—less than one-half of one per cent have been recorded as replaced for all causes.

We like to think of "Old Ironsides," the war-time Webster Radiator Trap, as literally "stripped for action." The design saves critical materials and machine-tool hours for direct war work. But, operating efficiency is unimpaired because "Old Ironsides" employs the time-tested Webster thermostatic element, a diaphragm of phosphor bronze fully compensated for pressure.

Construction features include cast iron bodies and bonnets, female inlet and outlet connections, angle body only. Three sizes of traps—½" for 200 sq. ft.; ¾" for 400 sq. ft.; ¾" for 700 sq. ft.

Webster Steam Heating Equipment is being made for authorized war-time projects—Army hospitals, theatres and administration buildings; the Navy's fighting ships; war plants, shipyards, airplane hangers; and for essential heating repairs.

We are proud to play our part in keeping steam heating available for its essential role in war-time . . . and we are doubly proud of our Army-Navy "E" awarded to us for producing many times the originally contemplated maximum on our Ordnance contract for the United States Army.

WARREN WEBSTER & COMPANY
Camden, N.J., Est. 1888, Pioneers of Vacuum Steam Heating

Official U. S. Navy Photo

Patients at U. S. Navy Hospital enjoy steam heating comfort

Official U. S. Marine Photo

U. S. Marines at "chow" in steam-heated mess hall

ARMY E NAVY

Webster
Steam Heating

WEBSTER PRODUCTS AND SERVICES

Process Steam Traps, Radiator Valves, Thermostatic Traps, Dirt Pockets, Dirt Strainers, Lift Fittings, Expansion Joints, Vacuum Governors, Unit Heaters, Boiler Protectors, Boiler Return Traps, Vent Traps, Vacuum and Vapor Systems of Steam Heating, Central Heat Controls, Heating Modernization Programs.

Buildings "essential to War Effort" may take any form from housing to hospitals, but each presents the same primary problem in specification: to use materials that will *last,* and thus conserve the Nation's stock-pile of critical metals.

When piping materials were selected for the new Statler Hotel in Washington, D.C., the architects took every precaution to insure this maximum durability. Water analyses were obtained and studied, and piping history in various old buildings was reviewed. Wrought iron was then specified, and Byers Wrought Iron Pipe was used, for suspended soil, waste, drain and vent piping; hot and cold water piping; down spouts; and heating return lines.

A recent survey of seven buildings in Washington revealed plenty of evidence of wrought iron's dependability. The buildings ranged in age from 6 to 43 years. Wrought iron was used for hot and cold water lines in all. In one, 43 years old, some replacements are now being made—with wrought iron again the chosen material. The original wrought iron lines are still serving in the others.

Steam return lines in six of the seven buildings are wrought iron, and have given no trouble. A major portion of the drainage lines is also wrought iron. Only one replacement (a leader) has been reported.

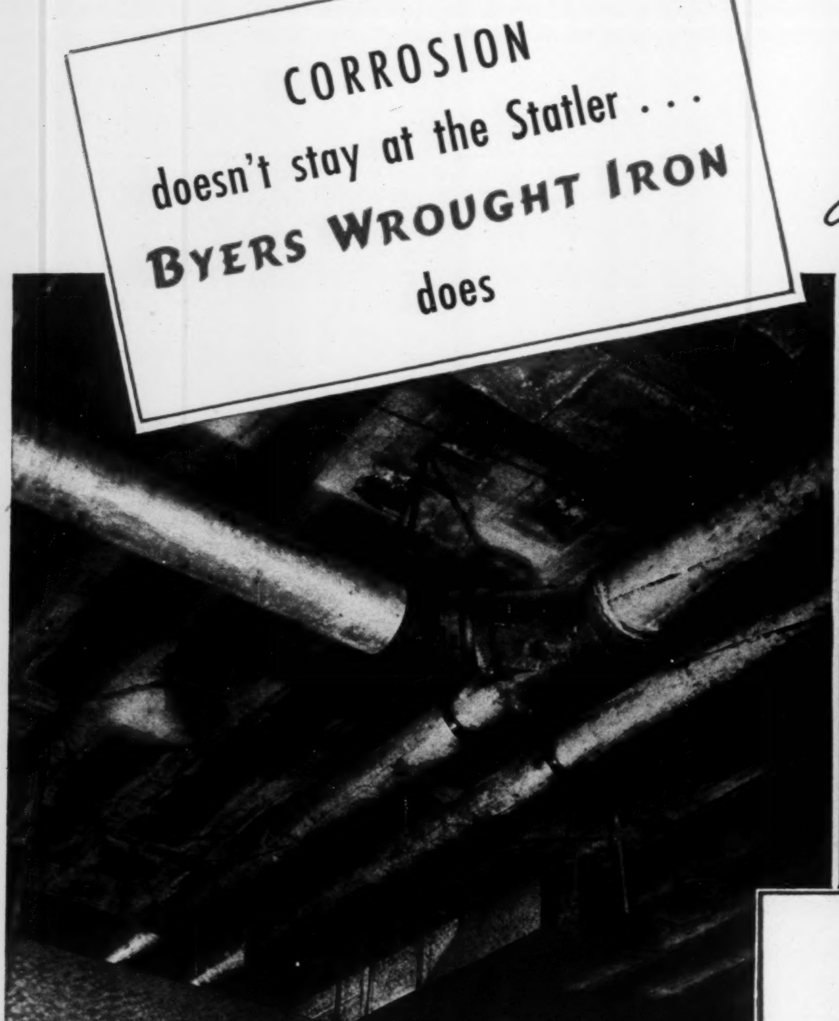
If you have any questions concerning the life expectancy of wrought iron in corrosive services, our Engineering Service Department is well equipped to help you find the right answers.

If you have any questions about availability and delivery, we urge that you also get the right answers, direct from "headquarters." Just contact a Byers Field Service Representative, the nearest division office, or Pittsburgh. When you feel that wrought iron is the best material to use, and the government—by its rating—indicates approval, the chances are excellent that we can meet your needs.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

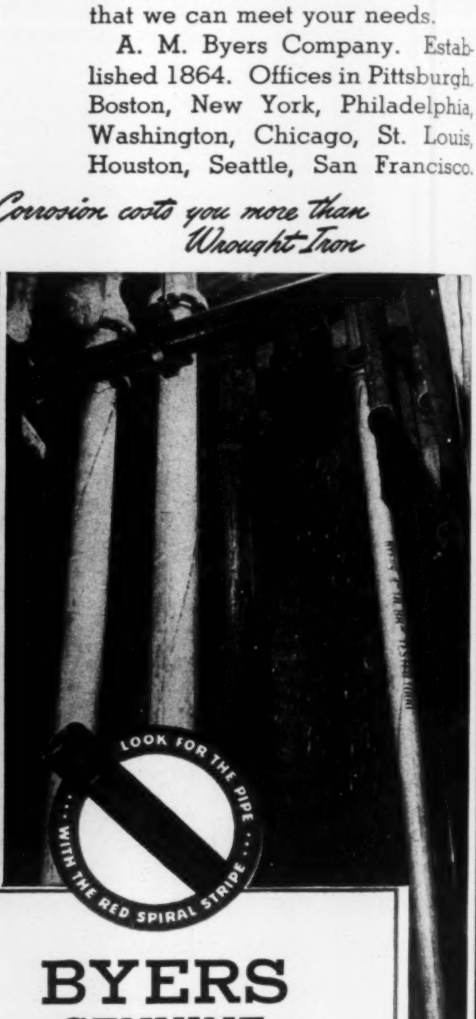
CORROSION
doesn't stay at the Statler . . .
BYERS WROUGHT IRON
does

Corrosion costs you more than Wrought Iron



PIPING IN STATLER HOTEL · WASHINGTON, D. C.

HOLABIRD & ROOT, *Architects* A. R. CLAS, *Associate Architect*

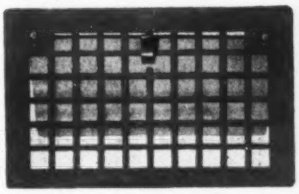


BYERS
GENUINE
WROUGHT IRON
Tubular and Hot Rolled Products
Steel Tubular Products

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1943 HEATING, PIPING & AIR CONDITIONING *and thus keep your records of sources of supply up to date throughout the year. Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.*

Nonmetallic Registers and Grilles

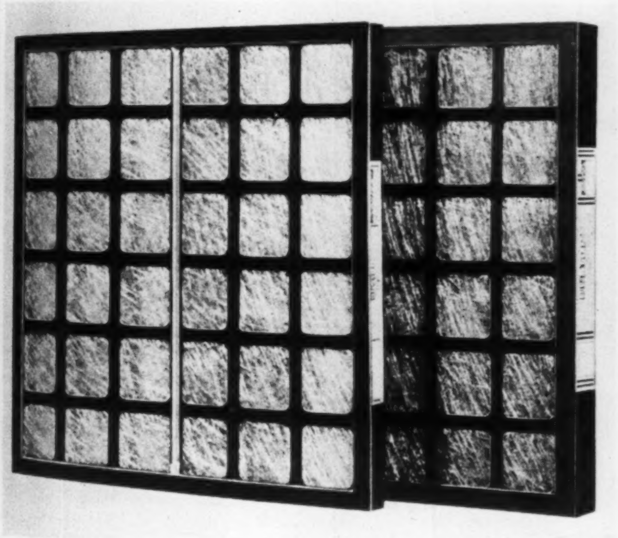


No. 2403 — A recently introduced line of nonmetallic registers and grilles was designed to save steel when conditions permit, and has been approved by government authorities for air conditioning installations in industrial plants and many other war projects calling for such units, according to the manufacturer.

The material used is tempered "Masonite," and it is said that field tests have proved the registers and grilles to be highly satisfactory substitutes for metal units. The present line is made in all standard sizes, and the company will also fabricate to individual specifications. — Standard Stamping & Perforating Co., 3131 W. 49th Pl., Chicago, Ill.

Wartime Air Filter

No. 2404—A new wartime "Dust-Stop" air filter which retains the filtering efficiency and economy features of the peacetime model while conserving metal and other critical materials has been developed.



A square grille of heavy kraft cardboard replaces the familiar metal grille with round openings. A standard filter adhesive is used in place of the non-inflammable adhesive which is no longer available.—Owens-Corning Fiberglas Corp., Nicholas Bldg., Toledo, Ohio.

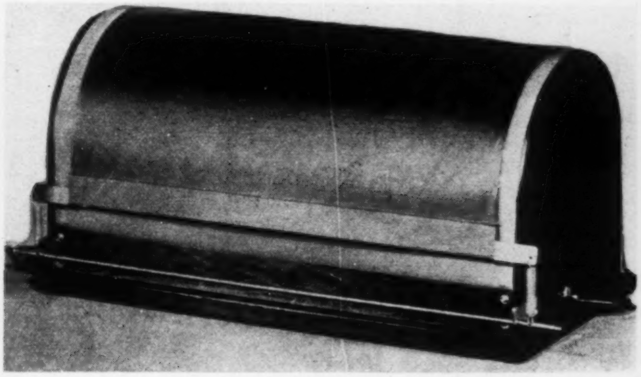
Pressure Transmitter for Gages

No. 2405—A new fire prevention device which weighs only 15 oz is helping to protect the lives of American bomber and pursuit pilots in action on the battlefronts of the world. The "pressure transmitter," which reduces the fire hazard in airplane cockpits eliminates the need for piping raw gasoline and lubricating oil to indicating meters in the cockpit of the plane, it was explained, thus keeping beyond the protective fire wall the feed lines carrying these volatile liquids, which may become severed in combat.

The transmission cell is constructed with two chambers divided with a synthetic rubber diaphragm. One side of the diaphragm is subjected to the pressure to be measured and the other side operated to transmit the measured pressure to the instrument panel gage. The transmitter is designed to withstand pressures up to 600 psi despite the fact that normal running conditions require only 15 psi on gas lines and 120 psi on oil. Oil in subfreezing temperatures congeals to the consistency of tar and until the motor becomes warm this heavy liquid is forced through the system creating excessive pressures. In such instances, the pilot has no way of knowing if motors are operating correctly unless his pressure gages are designed to work under extreme weather conditions.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn.

Photocopy Machine

No. 2406—Today's requirements for more and more paper work present a problem to the industrial field which is answered—at least in part—by a photocopy machine which



Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [3-43]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature.

(Circle each number in which you are interested):

2403 2404 2405 2406 2407 2408 2409 2410 2411 2412
4381 4382 4383 4384 4385 4386 4387 4388 4389 4390
4391 4392 4393 4394 4395 4396

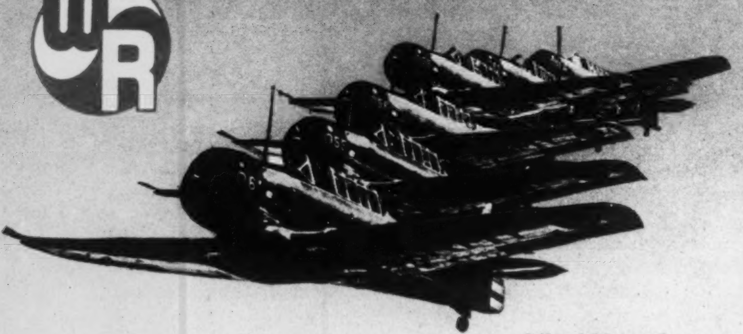
Name .... Title ....

Company ....

Address ....

City .... State ....

BUILDING FOR TOMORROW—
TODAY



Official Photo, Courtesy U. S. Army Air Forces

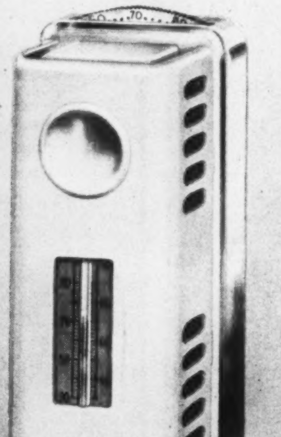
That's what America is doing — building for tomorrow so that when the boys come back from "over there" they will know that the folks at home have been in it too.

Today we at White-Rodgers are devoting our time and efforts to develop, design and produce controls for our Military and Naval Air Forces.

Tomorrow these wartime control developments will find many industrial and domestic applications to bring untold efficiency and comfort to a world at peace.

★

Series 150 Heavy Duty Line Voltage Room Thermostat —will handle multiple unit coolers or heaters—available with locked dial and "on," "automatic" and "off" dial positions to serve as manual control.



HYDRAULIC ACTION CONTROL

WHITE-RODGERS ELECTRIC CO.
1205c CASS AVENUE • SAINT LOUIS, MISSOURI
Controls for Heating • Refrigeration • Air-Conditioning

---

produces exact copies, in any size up to 18x22 in of an thing written, typed, printed, drawn, or photographed.

This machine produces perfect copies without a darkroo and without skill or technical knowledge, according to th manufacturer, and no comparison or proofreading required.

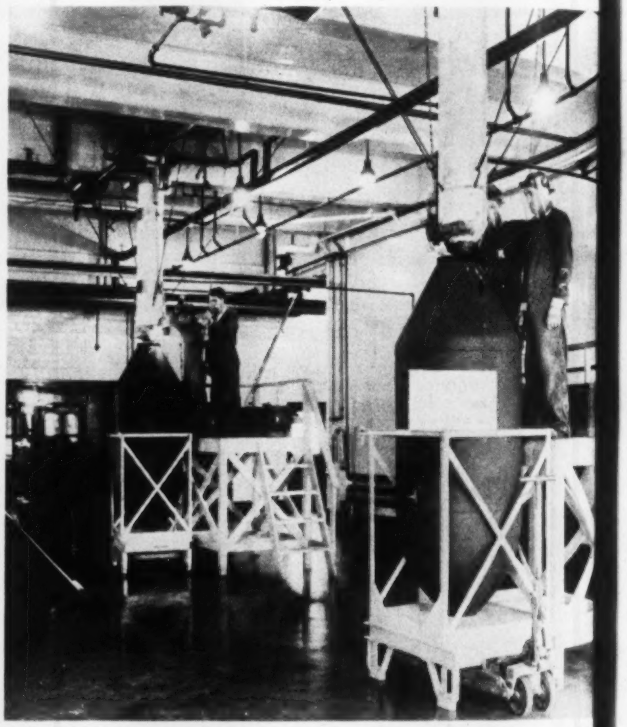
Engineering uses include making immediate copy directl from blueprints without tracings, copying specification and a multitude of other matters important in productio problems today.—American Photocopy Equipment Co., 28 N. Clark St., Dept. 107, Chicago, Ill.

Glass Fiber Insulation

No. 2407—An unforeseen byproduct of three large pip and equipment insulation jobs has been the establishmen of a unique record for ability to withstand rough treatmen by the glass fiber insulating materials employed, accordin to the manufacturer.

Two of the projects are ordnance plants and the third a naval training station. One, an ordnance plant turnin out shells and bombs, consists of over 600 buildings. Th project has its own heating, light, and power plants, man miles of railroad track and roads, and is self-sufficient a degree that would enable it to maintain production eve though surrounding areas were devastated by bombing. Th photo shows the filling of bombs at an ordnance plant.

The various buildings, spaced well apart so that explosion in one of them will not destroy the others, a heated by 14 central steam heating plants, from which th steam carrying piping runs, most of it above ground, the buildings. More than 1,000,000 linear feet of insulatio was required to insulate these pipes, which vary in si from ½ to 10 in.



Construction of the training station called for more tha 1,500,000 linear feet of insulation for the steam pipin supplying heat from the central heating plants to mor than 350 buildings, including barracks, mess halls, dri halls, study halls, and recreation structures. The thi project, an ordnance plant producing TNT, required approxi mately 1,000,000 linear feet of insulation for both stea and hot water piping.

In addition to the pipe covering, large amounts of sulation were specified for boilers and other equipment all three projects. At the training station, over 35,000 sq of surface on boilers, tanks, ventilating ducts, and breec ings required insulation. Insulation was specified for th furnaces in which TNT is treated at both ordnance plant

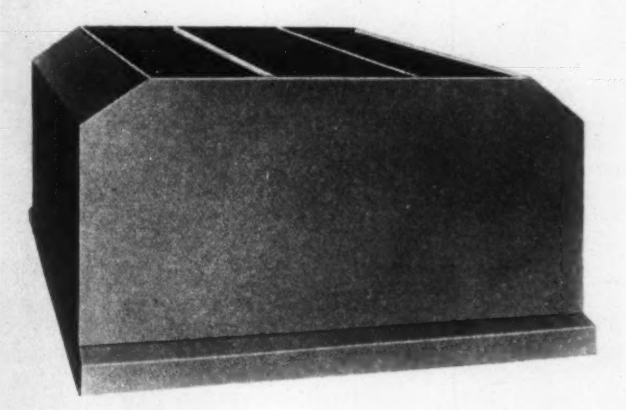
Construction of one of the ordnance plants and the training station was started in the dead of winter, with the temperature frequently well below the zero mark. To avoid risk of delaying the job it was necessary to have several carloads of the insulation materials on the site, but there was no warehouse space for its storage, and no time to build even makeshift shelter.

The insulation materials as they arrived at all three of the projects were unloaded from the box cars and stacked on the open ground. For considerable periods they were forced to withstand, without protection of any kind except the corrugated paper cartons in which they were packed, the effects of snow, ice, sleet, rain, and sun. During the winter it was often necessary to dig the frozen, ice crusted materials out of the snow, and thaw them out overnight in any heated shelter that could be found. All this the insulation withstood without damage or impairment of its thermal qualities, says the manufacturer.

Insulation of the molded type, with a covering of asphalt treated canvas, was used for pipe covering at all the projects. Blocks finished with glass fiber insulating cement and canvas were used for boiler and furnace surfaces. The insulation was installed by the Paul J. Krez Co.—Owens-Corning Fiberglas Corp., Nicholas Bldg., Toledo, Ohio.

Nonmetallic Roof Ventilators

No. 2408—Although the need for ventilation in all types of buildings is recognized more widely than ever before, it became necessary for the WPB to forbid the general use of metals in roof ventilators. In restricting the use of metals, however, the critical materials division recognized the necessity of proper industrial ventilation for the greatest war effort and accordingly permitted the manufacture of metal ventilators for "essential applications." These include applications where metal ventilators are necessary because of intense heat, corrosive fumes, etc. Other "scarce" materials are permitted for manufacture of ventilators intended for use in essential applications where critical metals are not vitally necessary.



A line of roof ventilators made of noncritical materials, named the "NCM" line, has also been announced. Metal used in these ventilators for bracing and assembling amounts to less than 5 per cent of the weight, according to the manufacturer. Several of the new designs parallel closely the original styles made of steel, and are found to be equally effective in performance, it is stated.—Swartwout Co., 18511 Euclid Ave., Cleveland, Ohio.

Synthetic Rubber Mountings

No. 2409—The line of "Vibro-Insulators" (rubber mountings) can now be made using "Ameripol" synthetic rubber. These mountings, which are used for the isolation and insulation of vibration, shock, and noise, have been offered for many years using natural rubber bonded to metal. They are expected to find wide application in many fields of war industry where the action of oils, grease, paint, fatty acids, or heat result in too rapid deterioration of natural rubber used on mountings.

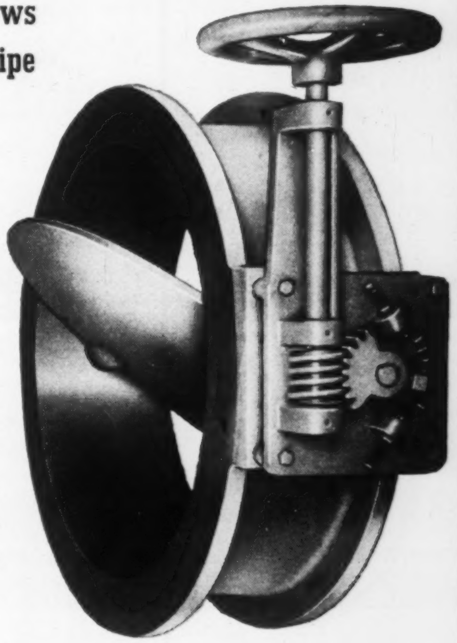
Whether made of natural rubber or synthetic rubber, most of these mountings are designed to carry the load in

6 Hand Wheel Revolutions

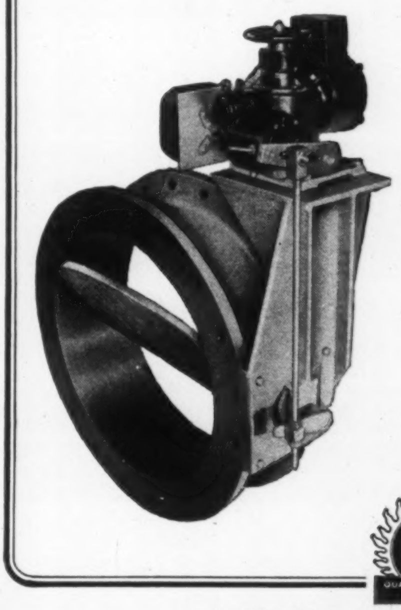
Complete Full Vane Movement

Designed for the control and wedge-tight shut-off of any material that flows or is forced through a pipe

Six revolutions of the hand wheel fully open or close this R-S Butterfly Valve. Compare this quick action with that of ordinary valves. Consider, too, that R-S Valves are comparatively light in weight. They effect a considerable saving in installation costs since less space and supporting structure are required.



15 to 900 p. s. i.



Electric Motor Operated

Here is a simplified, precise and entirely Automatic Butterfly Valve for the shut-off and control of liquids and gases in power plants, water works, chemical industries and refineries. Hand wheel for manual operation in case of current failure. Available in iron or steel; sizes to 84 inches.

●

Detailed information and catalog furnished upon request.

R-S QUALITY PRODUCTS SINCE 1908

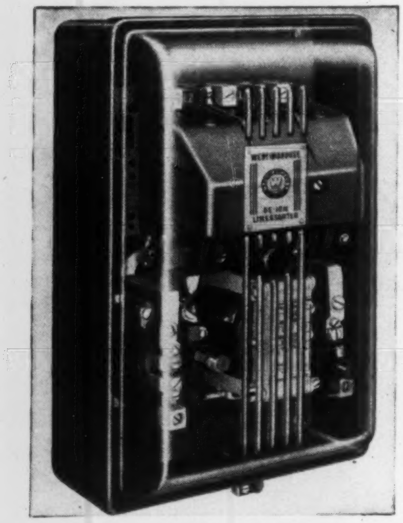
BUTTERFLY VALVE DIVISION
R-S PRODUCTS CORPORATION
132 Berkley Street • Philadelphia, Penna.

R-S Streamlined BUTTERFLY VALVES

shear, because rubber in shear has six times the resiliency of rubber in compression, the manufacturer states.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

New Line Starter

No. 2410—For pumps, fans, machine tools, and similar machines, a new size 2, class 11-200 "Linestarter" requiring less than half the mounting space of former units without sacrifice of wiring space has been announced.



This starter, designed for group mountings, builtin applications, or remote mountings, has a new clapper type armature with knife edge bearings. It utilizes double break silver to silver contacts, thus eliminating shunts and reducing maintenance. Overload relays are reset either by hand or automatically. On applications requiring sequence or auxiliary interlocking, provision is made for a total of four normally open or normally closed electrical interlocks. — Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Pump with Removable Liner

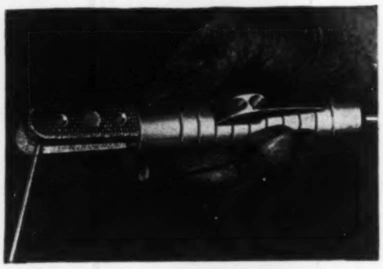
No. 2411—As a step in the conservation of the critical materials from which rotary pumps are made, production of a rotary pump with an improved removable liner has been announced.

This unit operates on the same "bucket design" (swinging vane) principle as all of the manufacturer's standard pumps, but it is so constructed that, when wear affects the capacity of a pump, the old liner may be easily removed and a new one set in place. The replacement operation involves only the removal of the pump heads, driving out the old liner, and inserting a new one. Neither piping nor drive is disturbed, and normally the pump can be back in operation in half an hour. Due to the self-adjusting buckets, no fitting is necessary.

Pumps with the improved removable liners are being made in capacities from 20 to 750 gpm and pressures up to 300 psi, and are available with reasonable promptness for plants in war production where proper priority rating may be extended.—Blackmer Pump Co., 1920A Century Ave., S.W., Grand Rapids, Mich.

Welding Electrode Holder

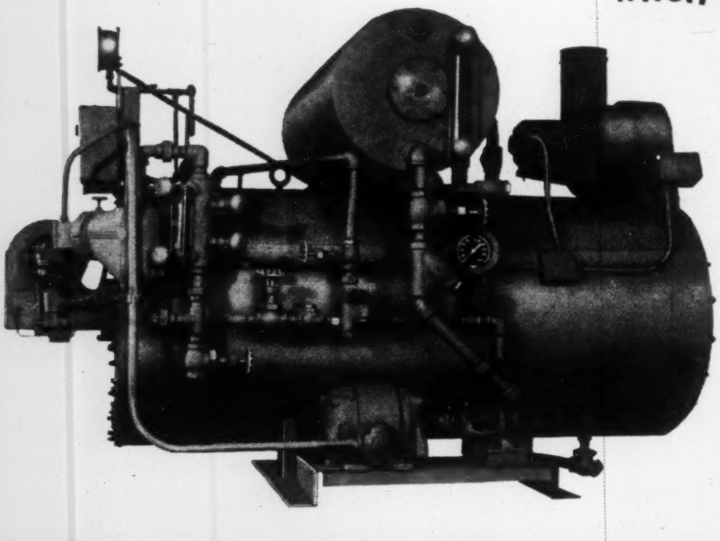
No. 2412* — An easily handled arc welding electrode holder designed for welding operations in such fields as heating, ventilating, and air conditioning work has been introduced.



It is made of special high conductivity copper alloy, has a rated capacity of 200 amp, takes rods from the smallest up to 3/16 in., has an overall length of 7⅞ in., weighs 12 oz, and has mechanical or solder cable connection, the maker states. Insulated, it protects the welder's eyes against flash and eliminates work spoilage that ordinarily results when a bare type holder contacts the work, it is said.—Jackson Products, Detroit, Mich.

TOUGH ENOUGH TO TAKE IT

when the going gets rough!



Whether in camp maneuvers or speedy action under fire — whether in sweltering heat or bitter cold — the Army's new mobile laundry units must be able to take it! Designed to stiff Army specifications as a vital part of the mobile unit — this compact 15 h.p. O & S Boiler is built to weather extremes in temperature and the bumps and jars of rough terrain. Its condensate return system is *built-in*—and offers *induced* draft in addition to these advantages:

- ★ 100 lbs. pressure from 60° water in 20 minutes!
- ★ Fully-automatic control!
- ★ Weight complete - 2100 lbs.!

Although developed expressly for mobile use in the Army's laundry units, this revolutionary O & S boiler promises wide application in your industry when Victory makes O & S boilers again available for all purposes.

ORR & SEMBOWER INC.
READING • PENNSYLVANIA
O&S
Builders of Better Boilers
Since 1885

FORTY-THREE STEPS OF CONTROL

in four inches!

The new Ward Leonard 4-inch Pressed Steel Rheostat offers the happy combination of a small sturdy power rheostat with a large number of steps, and ample current carrying capacity. Like all Ward Leonard Pressed Steel Rheostats this model may be arranged for front of board, rear of board and multiple assembly mounting. Other types and sizes also available. Send for descriptive bulletin.

WARD LEONARD

Electric control devices since 1892.

WARD LEONARD ELECTRIC COMPANY, 31 SOUTH STREET, MOUNT VERNON, NEW YORK

WECO-N.G.E. Series F600 GAS BURNERS

hese burners are available for atings from 50,000 to 10,000,-00 B. t. u. output, for use in eating boilers, power boilers — any metal firebox or sectional oiler. Featuring flexibility to eet various firebox shapes and izes at various gas pressures, nd low draft loss. Full auto-atic controls that operate roperly can be easily applied.

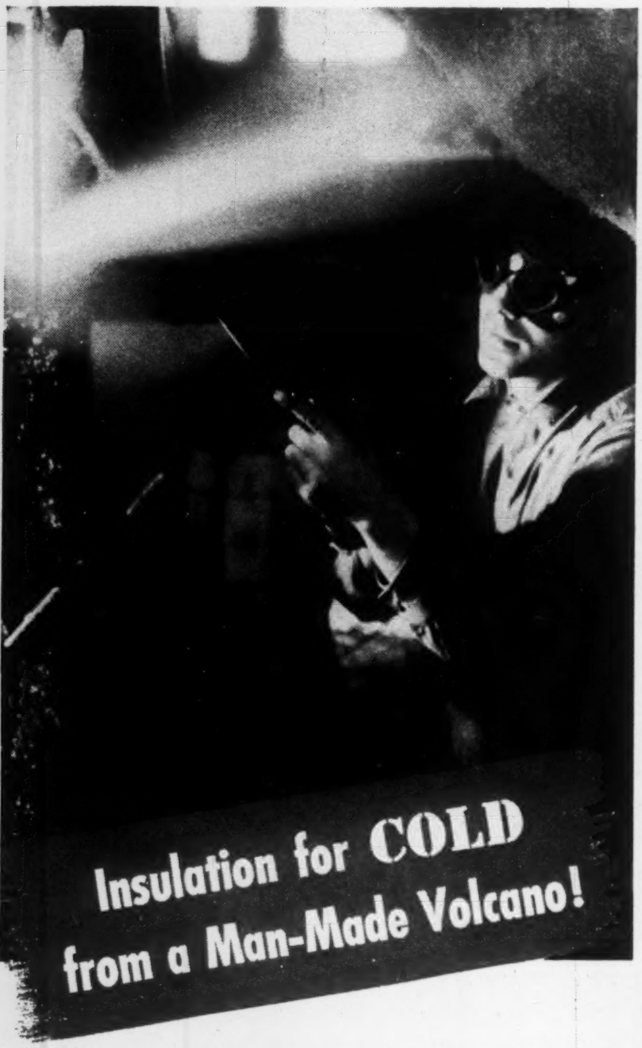
GUARANTEED VIBRATIONLESS

This burner operates on straight natural gas and mixed gas to 800 B.t.u. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

HE WEBSTER ENGINEERING CO.

TULSA — DIVISION OF — **OKLAHOMA**

Surface Combustion . . . . Toledo, Ohio



ACCORDING TO LEGEND, the first mineral wool was produced during an eruption of the volcano Kilauea in Hawaii. Geological survey revealed this substance to be lava, blown into soft threads by the gigantic forces of the volcano.

Today, at Johns-Manville factories, in man-made volcanoes, molten silica minerals are blown by means of steam into silky fibers. These mineral fibers are formed into Rock Cork, which is exceptionally efficient for low-temperature insulation. Rock Cork is immune to termites, vermin and mold. It can't rot, does not absorb odors.

Mineral wool is one of four basic materials from which all Johns-Manville products stem: Asbestos, asphalt, diatomaceous earth and mineral wool. Today, Johns-Manville has but one aim: To make these products in the quantities needed to help win the war. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM

Johns-Manville
ROCK CORK

PETRO

REG. U. S. PAT. OFF.

OIL BURNING SYSTEMS FOR 194?

Today Petro's entire capacities are devoted to war production—burners for war and many items nobody would have expected to come out of an oil burner factory.

But development research can be advanced with no detriment to the war effort, and Petro's engineering corps is working steadily on such things.

Much helpful knowledge already has come from Industry's war effort. Petro systems have carried terrific overloads month after month. Such conditions telescope time for research engineers. Each month of such operation provides data and studies equal to years of peace time.

Similarly, Petro's manufacturing of war materiel has developed much that will be directly beneficial when large scale production of Petro oil burning equipment is resumed. Because no changes in Petro equipment are ever made until ample proof of betterment is established, no specific report can be made now.

So, when Heating Contractors are busy with post-war buildings they can be sure that the Petro oil burning equipment they will have for consideration will deserve a place in those better buildings.

And at that time, qualified Petro engineers will be available to consult and cooperate on the selection, specification and installation of oil-firing equipment that will squarely meet the future's standards of operating efficiency.

OIL IS AMMUNITION USE IT WISELY

Full data on Petro Industrial Burners are in our Catalog —see Sweet's or Domestic Engineering Catalog Files— or we will gladly send copies on request.

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD — CONNECTICUT

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 119. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to HEATING, PIPING & AIR CONDITIONING.

Acetylene Generators

No. 4381—Leaflet describing portable high pressure acetylene generators for welding, cutting, soldering, and brazing, of particular interest due to the prevailing shortage of acetylene bottles.—Adler Mfg. Co., 1440 N. 4th St., Milwaukee, Wis.

Air Conditioning Patents

No. 4382—Leaflet listing the general licensees and installer licensees under "Acco" air conditioning system patents. The various groups of bypass, differential control, dehydration, and miscellaneous patents are also listed.—Auditorium Conditioning Corp., 17 E. 42nd St., New York, N. Y.

Ball Bearing Regrinding

No. 4383—16 p. booklet discussing and illustrating the types and styles of ball bearings that can be reground and explaining the manufacturing procedure in renewing worn ball bearings. Much helpful information is included.—Ahlberg Bearing Co., 3081 W. 47th St., Chicago, Ill.

Compressors and Vacuum Pumps

No. 4384—20 p. bulletin (B-6211) on "Ro-Flo" compressors and pumps of the sliding vane type, giving a complete engineering description supplemented by installation diagrams; curves showing the relationship between pressure, temperature, and volume; photographs; and section views.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Corrosion Data Work Sheet

No. 4385—4 p. corrosion data work sheet, designed to assist engineers in studying corrosion problems, which is used as a check list to insure consideration and evaluation of all factors influencing corrosive action.—International Nickel Co., Inc., 67 Wall St., New York, N. Y.

Dissolved Oxygen Test Kit

No. 4386—4 p. bulletin (W-210-B28) describing a dissolved oxygen test kit comprising portable apparatus for accurate determination by the Winkler method of the dissolved oxygen content of deaerated boiler feedwater. A countercurrent sample cooler used in testing is also described.—Worthington Pump & Machinery Corp., Harrison, N. J.

Hydraulic and Pneumatic Packings

No. 4387—4 p. operating analysis chart for specifying and keeping accurate shop records of hydraulic and pneumatic U packings, including a description of the features of the manufacturer's double U packing.—Wayne Davies & Co., 325 W. Huron St., Chicago, Ill.

Industrial Molded Rubber Goods

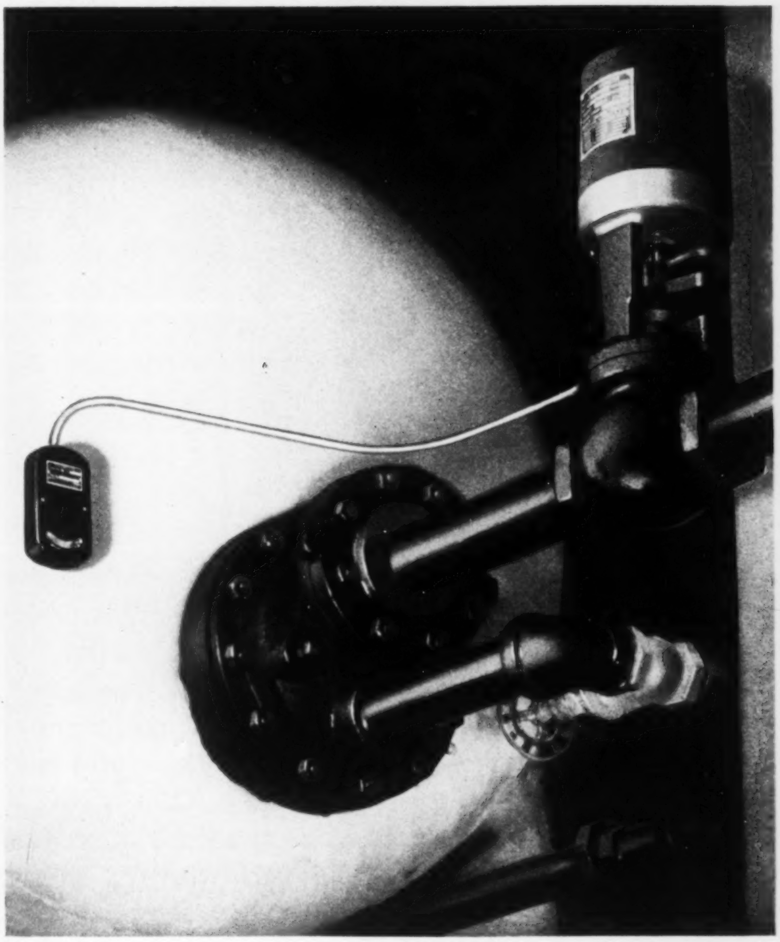
No. 4388—8 p. bulletin (catalog section 7020) on industrial molded rubber goods, designed to supply practical

BARBER-COLMAN

GRILLES & REGISTERS
AIR DIFFUSERS

MAXIMUM SERVICE
Controls
by
BARBER-COLMAN COMPANY
MINIMUM MAINTENANCE

AUTOMATIC
CONTROLS



AUTOMATIC CONTROLS FOR HOT WATER STORAGE

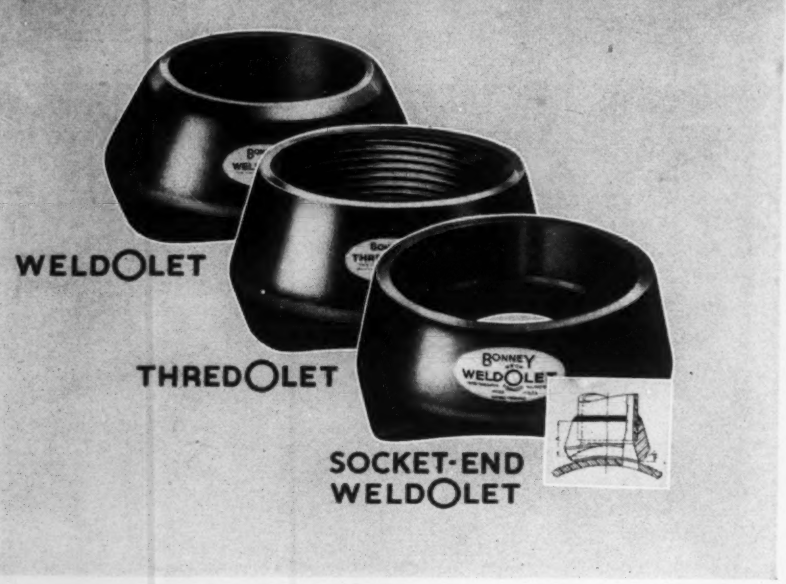
★ In many plants, ordnance depots, and training centers, especially those with large or scattered buildings, the storage of an adequate supply of hot water for washing and other purposes presents a problem of temperature control as well as of proper size and distribution of tanks. Actually, a control installation on each of a number of tanks will usually reduce the operating cost over the installation of a control on the central supply alone.

WATER KEPT HOT AT MINIMUM EXPENSE

★ With a simple BARBER-COLMAN CONTROL, consisting of a Thermostat in the tank and a Motor-Operated Valve on a steam supply line, the water in each tank is automatically maintained at the desired temperature. Heat losses from water supply lines are reduced to a minimum and the amount of steam used is also kept at a minimum by the automatically-operated valve. Once the thermostat is set, practically no attention is required for either adjustment or maintenance. BARBER-COLMAN equipment is quality-built throughout to assure a long life of dependable operation.

BARBER-COLMAN COMPANY 1228 ROCK STREET
ROCKFORD, ILLINOIS

DEPENDABLE



YES sir! Bonney WeldOlets and ThredOlets *are* dependable. So dependable they provide leak-proof, right-angle, welded branch pipe outlets of full pipe strength without the use of templets, cutting, threading or alignment of the main pipe. Installed by electric-arc or oxy-acetylene method and any welder of average ability, they provide junctions that improve flow conditions . . . reduce turbulence and friction to a minimum.

Light in weight, they save metal, eliminate the need of extra braces at the junction . . . save money on original cost when compared to tees . . plus time and money in actual installation.

Suitable for all commonly used pressures and temperatures and available from stock for all pipe sizes up to 12″ . . . on special order up to 24″. Stock fittings are drop forged steel . . . but to meet unusual conditions they can be furnished in Monel, Toncan Iron, wrought iron, Everdur, etc.

Branch Pipe Outlets
with
BONNEY
WELDOLETS
THREDOLETS
and SOCKET-END
WELDOLETS

Get this 16 page bulletin that tells in detail all the advantages of these fittings. Write for Bulletin WT31.

Once used, you'll never use any other welding fittings for making right-angle welded branch pipe outlets.

Forged Fittings Division

BONNEY FORGE & TOOL WORKS, Allentown, Pa.

WELDOLETS·
TRADE MARKS - REG. U. S. PAT. OFF.
THREDOLETS
Welded Outlets for Every Piping System

information for those who need guidance in the use, application, and development of these products.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Lathes

No. 4389—20 p. bulletin (H-3) on the installation and leveling of the lathe, covering many points which must be taken into consideration when installing this equipment so that the most efficient operation can be obtained.—South Bend Lathe Works, 425 E. Madison St., South Bend, Ind.

Motor Record Card

No. 4390—Motor record card (GES-1526A) in 4x6 in. size for card files, containing spaces for the recording of essential information on each motor in a plant as well as the nature and extent of inspection and repairs.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Nonmetallic Sheets

No. 4391—16 p. booklet describing improved "A.R.A." sheets, which are offered as an alternate or substitute for sheet metal. Features of the sheets are described in detail.—Grant Wilson, Inc., 4115 W. Taylor St., Chicago, Ill.

Plastic Cork Coating

No. 4392—32 p. handbook on "NoDrip" plastic cork coating, telling how to prevent and cure damaging condensation and sweat that forms on piping, tanks, walls, ceilings, and various industrial equipment. Among the subjects treated are air ducts, ammonia and brine lines, corrosion, drying, hot water and steam lines, rust prevention, tanks, vapor barriers, etc.—J. W. Mortell Co., Kankakee, Ill.

Sheet Metal Welding

No. 4393—16 p. booklet of sheet metal welding fundamentals, including an instruction outline for welding light gage sheet and tubing.—The Linde Air Products Co., Unit of Union Carbide and Carbon Corp., 30 E. 42nd St., New York, N. Y.

Shift Schedule

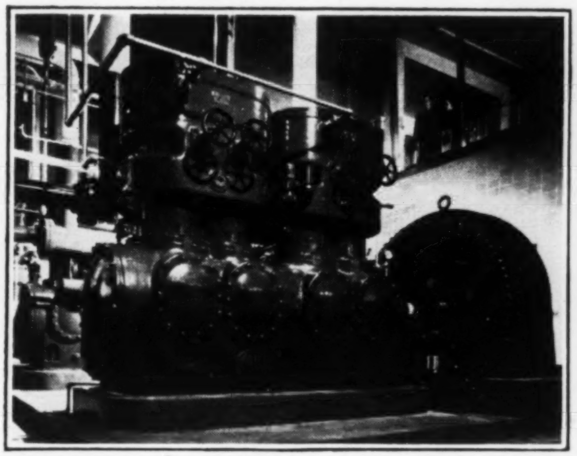
No. 4394—Cardboard "Shiftograph" that gives a perpetual work shift schedule, which has been designed and is being distributed as a contribution to our national war effort.—George S. May Co., May Bldg., 2600 North Shore Ave., Chicago, Ill.

Temperature Regulation

No. 4395—12 p. manual of temperature regulation (S-743) giving interesting and helpful information on how to reduce the consumption of heating fuel and including a study of the "Tri-Trol" regulator. Illustrations show how the regulator automatically controls morning warm up and night shutdown periods and how it anticipates changes of inside temperatures during the day and changes the rate of firing accordingly. Several pages are devoted to questions and answers on today's heating problems.—Marsh Tritrol Co., 600 S. Michigan Ave., Chicago, Ill.

Welded Fabrication

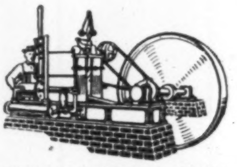
No. 4396—4 p. bulletin (3) on "Saxe" welded erection system for buildings, steel trestles, bridges, and similar structures. The principle of the method is described and illustrated and a partial list of users is given.—J. H. Williams & Co., Buffalo, N. Y.



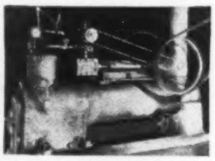
90 Years' Engineering Experience Stands Behind

FRICK
TRADE MARK

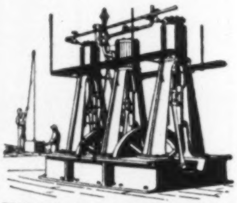
Refrigeration



FRICK STEAM ENGINE, BUILT 1856 NOW IN THE FORD MUSEUM



THIS FRICK ENGINE AND BOILER, BUILT IN 1877, ARE STILL IN SERVICE AT MADISON, VA.



FRICK REFRIG. MACHINE OF 1883

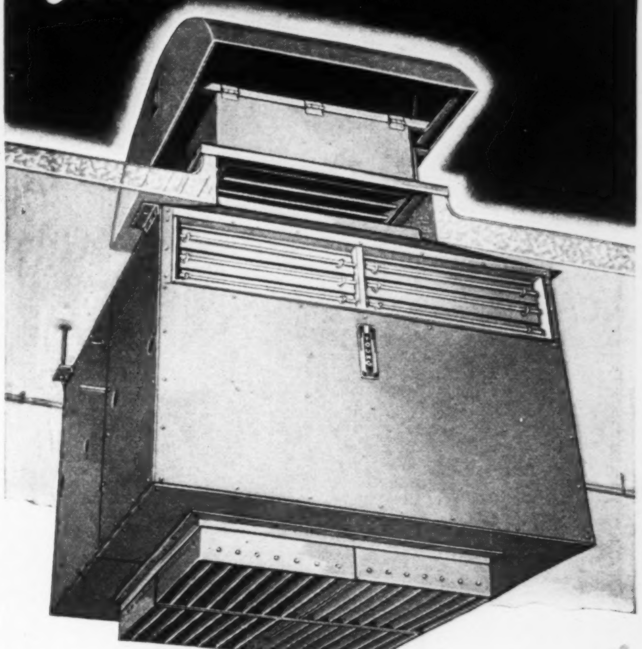
To be within ten years of its One Hundredth Anniversary is a distinction enjoyed by very few companies in America.

Frick Company was established in 1853 for the building of steam engines. The success of these led to the construction, in 1882, of the first Frick Refrigerating machine.

Today, Frick cooling systems are put into war service as fast as they can be made. Tomorrow, you can get the advantages of up-to-date Frick Refrigerating, Ice-making, and Air Conditioning Equipment, backed by more than 90 years' experience.

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

Beat the Blackout



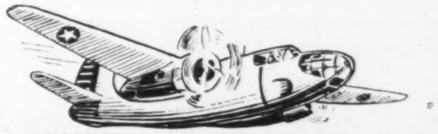
NEW Young VERTIVENT

HEATER AND VENTILATOR

War plants, designed to be blacked out completely without interrupting production, cannot be satisfactorily conditioned by window ventilation and recirculating type heating equipment. The new YOUNG VERTIVENT meets blackout requirements and helps maintain ideal working conditions to boost worker efficiency. The VERTIVENT takes fresh air from the outdoors through a light-proof hood, draws it through heating coils and distributes it uniformly. It can be automatically regulated to meet hour to hour requirements and is equally well adapted to new construction or to existing buildings. YOUNG standard heating coils of the proper size take care of a wide range of requirements ranging from the tempering of 100% outside air at minus 20° F. or lower, to conditioning 100% recirculated air without over-heating. For complete information and installation data, write to:

YOUNG RADIATOR COMPANY, Dept. 113C
RACINE, WIS., U.S.A.

★ ★ ★ ★ ★ ★



YOUNG PRODUCTS FOR THE VICTORY PROGRAM
In addition to heating and air conditioning units for Defense plants, military cantonments, etc., the Young Radiator Company manufactures more than 100 heat transfer products for the Army, Navy and industries vital to the Victory Program.

Young
HEATING, COOLING
AND AIR CONDITIONING UNITS

WHITLOCK
PREFABRICATED
PIPING

Whitlock Pipe Bends, Headers, Flanged Joints, etc., have been widely used for years and for many services. As illustrated, pipe bends can be supplied in practically any shape and in a wide range of pipe sizes and bending radii—with plain ends, cast iron or steel flanges, and with screwed, welded, or Van Stone joints.

May we quote on your needs.

THE WHITLOCK MANUFACTURING CO.
44 South Street • Elmwood, Hartford, Conn.
DISTRICT OFFICES IN
New York • Chicago • Boston • Philadelphia
Detroit • Richmond

Coming Events

Power Conference

Midwest Power Conference: April 8-9, Palmer House Chicago, Ill. Papers scheduled include Breaking Bottlenecks in Piping Materials, by G. W. Hauck, Crane Co.; Small Hand Fired Furnaces, by J. R. Fellows, University of Illinois; Conversion from Oil to Coal Fired Steam Generation; and Effect of Coal Sizing on Efficiency and Operation of Mechanical Stokers, by Otto de Lorenzi, Combustion Engineering Co. Sponsored by Illinois Institute of Technology with the cooperation of nine other schools and seven local professional engineering sections. The conference director is Stanton E. Winston, professor of mechanical engineering, Illinois Tech, 3300 Federal St., Chicago, Ill.

Foundry War Production

American Foundrymen's Association: 47th annual meeting, April 28-30, Hotels Jefferson and Statler, St. Louis, Mo. Meeting is to be a "mobilization of management, technical and operating men for devising ways and means for extending use of cast metals in the war effort." Headquarters office of the AFA is at 222 W. Adams St., Chicago, Ill.

Refrigerating Engineers

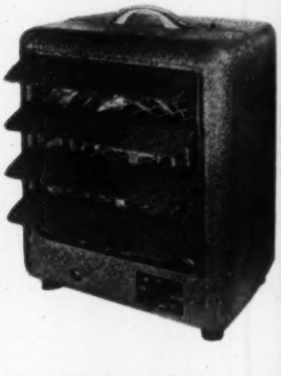
American Society of Refrigerating Engineers: 30th spring meeting, June 1-2, Hotel Statler, Cleveland, Ohio. Low temperature refrigeration is to be stressed. Headquarters office of the ASRE is at 50 W. 40th St., New York, N. Y.

Smoke Prevention

Smoke Prevention Association: 37th annual meeting June 8-11, Hotel William Penn, Pittsburgh, Pa. Headquarters office, 139 N. Clark St., Chicago, Ill.

Shut down heating boilers a month ahead, by employing

CHROMALOX
ELECTRIC
AIR HEATERS



Type HF heater. In four sizes from 1.5 to 4-kw. Other types up to 40-kw. for heating large areas. Thermostatic control if desired.

Widely used for auxiliary heating in plants and offices. Great for extra cold winter days, for overtime heat, for snappy weather in Spring and Fall and (with blower only in action) to circulate air on hot summer days.

Keep shop and office temperatures right, in spite of sudden weather changes.

Give heat only when it's needed—never too hot, never too cold.

Make a little heat go a long way, by setting up warmed air circulation. Column of air can be directed as needed.

As easily installed as an electric light—anywhere a wire line can go.

Save fuel, man-power, heating cost. Check with your power company, or write us.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

Useful Information

Air Conditioning Analysis

Reviewed by J. I. Yellott, professor of mechanical engineering, Illinois Institute of Technology

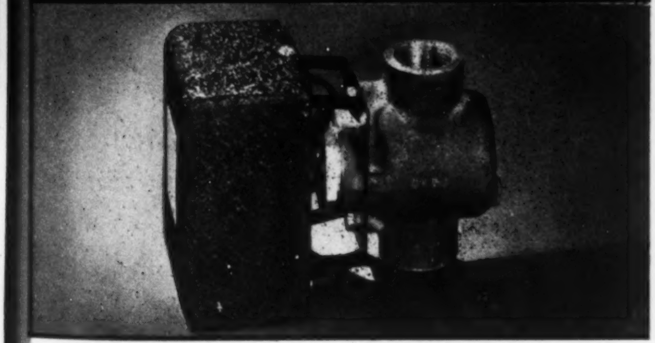
A new book, Air Conditioning Analysis, by William Goodman, consulting engineer, the Trane Co., and a member of HPAC's board of consulting & contributing editors, was published last month.

In his preface to this excellent book, the author states that his purpose is to present a comprehensive, unified treatment of the fundamental elements involved in changing the condition of air. He purposely omits the detailed treatment of the apparatus and equipment by which air is customarily handled, and confines his analysis to the basic science of air conditioning.

Mr. Goodman has long been recognized as an outstanding authority in his field, and his book is, therefore, an exceptionally valuable contribution. His method of presenting his subject, his simple derivations of essential equations, and his effective use of unorthodox psychrometric charts are familiar to readers of Heating, Piping & Air Conditioning, since much of the material in his book has appeared previously in this magazine. In its present form, Mr. Goodman's material is required reading for all who are concerned with the scientific aspects of air conditioning.

In his first chapter, the author establishes the well-known relations for dry air, and then considers the effect of the presence of water as a vapor, a liquid, and a solid. He departs from the usual treatment by considering the possibility of temperatures below 32 F or above 212 F, as well as the existence of barometric pressures other than

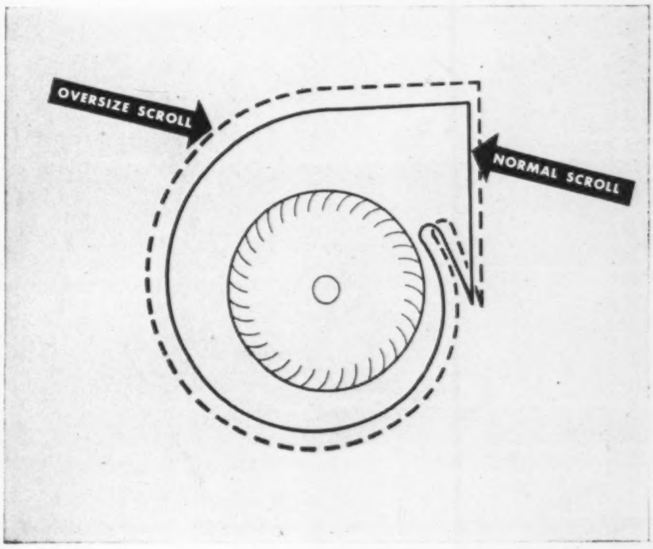
LOW WATER CUT-OUTS
ALL-ELECTRIC—FOR OIL, COAL AND GAS-FIRED BOILERS
—They're just right!
NO MOVING PARTS IN WATER • NO STUFFING BOXES OR PACKING GLANDS • SMALL ELECTRODE CHAMBER—MINIMUM SLUDGING-UP LIGHT IN WEIGHT—COMPACT—GOOD LOOKING • GREATER SAFETY FROM POSITIVE CONTROL • LONGER SERVICE LIFE—GREATER SERVICE ABILITY • FURNISHED FOR LINE VOLTAGE AND MOTOR CAPACITIES 1 h.p. R.I.—½ h.p. S.P. • PRESSURES, FROM LOW TO 150 LBS. MAX.



THE ONLY MOVING PART of this cut out is the armature and mercury tube. Nothing to wear out, or fail to function. Small volume electrode chamber minimizes settling of suspended particles or mudding-up. Dual voltage coils permit either 115 v. or 230 v. A.C. connections on the job. Low electrode voltage. Electrode insulators guaranteed to withstand action of steam and water under pressure. Adaptable to all units requiring 1" IPS connections, at pressures up to 150 pounds and temperatures to 366° F. Available with alarm circuit. Other models for various mountings described In No. 52 Catalog. Request your copy.

GENERAL CONTROLS
450 East Ohio St., Chicago, Ill.
267 Fifth Ave., New York City

Tips for Designing Air Impelling Units
No. 3 of a series



Housing Scrolls

As the performance of a blower wheel varies with the dimensions of the scroll of its housing, the scroll selected for a given wheel must be of the proper size in order to insure the satisfactory performance of the unit in which the blower is used.

To aid in this selection, the Torrington Blower Wheel Catalog (sent on request) gives the dimensions of the scrolls used in determining the ratings of all blower wheels listed.

In many cases, the dimensions for two scrolls are given:

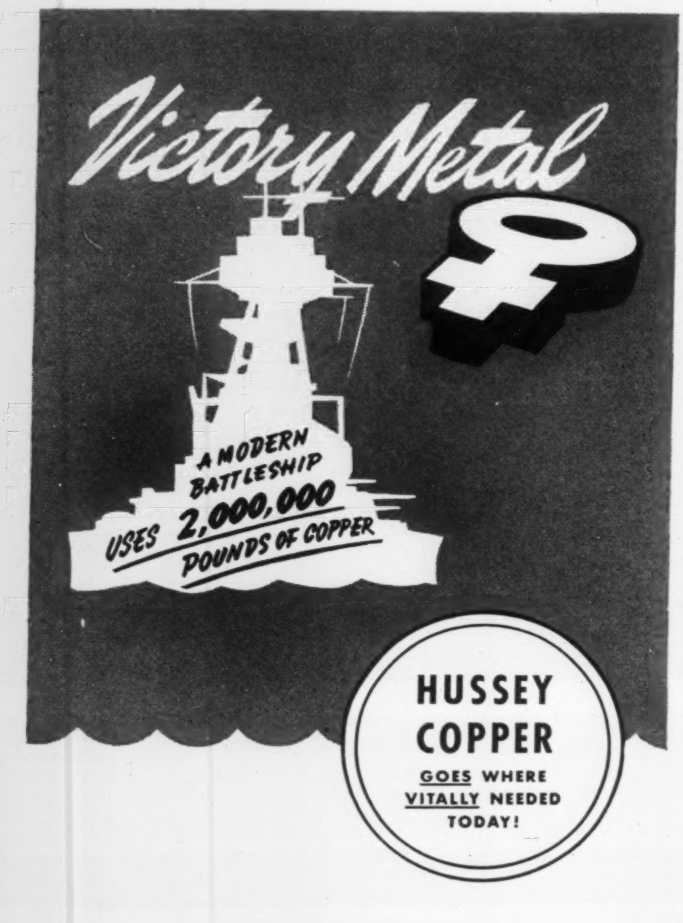
A *normal* scroll, which provides good performance when the housing space is restricted.

An *oversize* scroll, which develops more free air than the normal scroll and may be used when space permits.

Consultation with our Research Laboratory during the early stages of design may prevent costly changes and production delays.

THE
TORRINGTON
MANUFACTURING CO. TORRINGTON, CONN.

MANUFACTURERS OF AIRISTOCRAT QUIET PROPELLER FAN BLADES AND AIROTOR BLOWER WHEELS


Victory Metal
A MODERN BATTLESHIP USES 2,000,000 POUNDS OF COPPER
HUSSEY COPPER
GOES WHERE VITALLY NEEDED TODAY!

America's copper supply will determine the number of fighting vessels and other major war vehicles we can produce to defeat the Axis.

Today,—every available pound of HUSSEY COPPER is going into direct military orders —or essential war industry uses.

HUSSEY

C. G. HUSSEY AND COMPANY
(Division of Copper Range Co.)
Rolling Mills and General Offices: Pittsburgh, Pa.
Warehouses in Principal Cities

14.7 psi absolute. Designers of equipment for aircraft will find this information particularly useful.

Enthalpy rather than "total heat" is used by the author throughout the entire book, and he clearly justifies this departure from the conventional treatment. By this practice, and by the use of heat and moisture balances, air conditioning processes are shown to be similar to other thermodynamic problems.

As any follower of Mr. Goodman's previous work would expect, the psychrometric chart plays a very important part in his analyses. Instead of the conventional chart which presents dry bulb temperature as the abscissa and specific humidity as the ordinate, the author uses enthalpy as the abscissa and specific humidity as the ordinate, thus following Mollier, whose name is well known to all steam men. The tremendous value of the *h-w* chart as a tool for air conditioning analysis is shown in detail, and the fog which has previously existed in the unexplored territory to the left of the saturation line is dispelled very convincingly.

The moisture ratio, defined by the author as the quantity of heat added to the air per pound of moisture added, is used in conjunction with his psychrometric charts, and the usefulness of ratio lines and ratio angles is clearly demonstrated. Rapid and accurate graphical solutions are shown for the usual air conditioning processes. Instead of describing the apparatus by which these processes are accomplished, the fundamental principles are thoroughly established. The various methods of changing the temperature and humidity of air are explained in terms of the changes instead of the equipment which produces them. The quantities of air, heat, and moisture which are involved are shown to depend upon rational heat and moisture balances, and the use of the *h-w* chart makes the solution of most problems a relatively simple process.

Reheating and refrigerating, an apparently paradoxical combination, are shown to be necessary in many applica-

NOW we're putting our Heart* into the Fight!

GEROTOR
PUMP

***The heart of the May Oil Burner is the famed Gerotor Pump. Now it is also the heart of many vital war machines.**

Quiet MAY Oil Burners

tions, and the available methods of restoring heat to air which has just been cooled are explained in detail. The significance of bypassing is also considered.

The concluding chapters of the book discuss the principles which underlie the operation of cooling and heating coils, water sprays, evaporative condensers, chemical dehumidifiers, and air washers. Qualitative and quantitative methods are given, in which the humidity-enthalpy chart and the water-air chart are used effectively.

One of the most valuable features of this work is the excellent tabular presentation of psychrometric data. Thirty-two tables are given, covering 158 pp. Many of the tables have previously appeared in this magazine, although a change has been made which eliminates negative values for the enthalpy of dry air in the useful temperature range. The most extensive table presents the properties of saturated air by steps of 1/10 deg, from —40 F to 125 F for the barometric pressure of 29.921 in. of mercury. The same data are also presented, by 1 deg steps from —40 F to 200 F for barometric pressures from 22 to 32 in. of mercury, by 1 in. intervals. Other tables give the properties of saturated water vapor, of vapor over subcooled water and ice, and the specific humidity for air at pressures from 5 to 100 psi absolute.

The author has rendered a great service to the engineering profession by assembling in convenient form the data from which any air conditioning problem can be solved, and by setting forth in clear and logical fashion the basic principles on which the science of air conditioning must rest. He has taken a long step forward in raising the status of this subject from an art where intuition and empiricism have too frequently prevailed to a science where the trained engineer can make an exact air conditioning analysis.

This book is published by the Macmillan Co., 60 Fifth Ave., New York, N. Y. It has 455 + xv pp., 6¼x9¼ in., of which 158 pp. are tables. There are seven large charts. Price, $6.00.

De-Sta-Co

Blower Wheel Housings

of Standard Dimensions

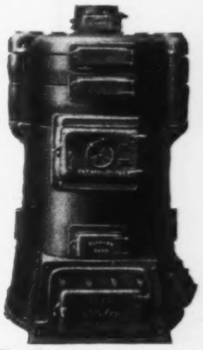
Made in sizes to fit 4½, 5, 6, 7½ and 9 inch wheels and in widths to suit single or double inlet wheels . . . also individual parts for your own assembly.

De-Sta-Co housings are engineered for maximum efficiency and quietness in operation . . . neatly finished. Send for "De-Sta-Co Blower Housings" bulletin; gives complete information, including essential dimensions.

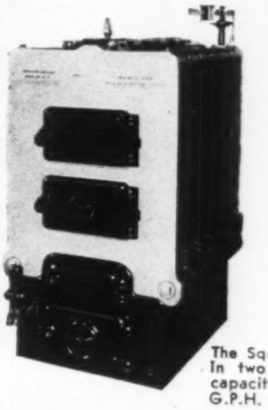
DETROIT STAMPING CO.
Established Over 25 Years
337 Midland Ave • Detroit, Mich.

HOT WATER SUPPLY BOILERS

For Military and Civilian Needs



The Round Series is made in six grate diameters with capacities from 75 to 485 G.P.H. 100° rise.



The Square Series is made in two grate widths with capacities from 167 to 1089 G.P.H. 100° rise.

THE important part *Hot Water for Health* is playing in our War effort is obvious.

Our Soldiers need it for bathing and shaving.

Mess halls need it for washing and sterilizing dishes, cooking utensils, etc.

Hospitals need it for all of the above purposes—but civilians need hot water, too.

We are now permitted to ship and have available for civilian use most sizes of Hot Water Supply Boilers both in round and square types.

Burnham Round Hot Water Supply Boilers (75 G.P.H. and larger) are of sectional construction but shipped assembled—saves time and money.

All Burnham Hot Water Supply Boilers are constructed for high pressure operation in accordance with the ASME Code and meet the requirements of all Government Agencies.

Write for literature and prices.

BURNHAM BOILER CORPORATION

Irvington, N. Y., Dept. P
Zanesville, Ohio, Dept. P

Burnham Boiler

KRAMER

Products

Coils:

BARE TUBE, FINNED, PLATE.

Condensers:

AIR COOLED, EVAPORATIVE, WATER COOLED.

Unit Coolers:

COOLMASTER, FREEZING OVEN, (Electric Defrost)

FREEZING SHOWER, (Water Defrost)

FLOOR TYPE, RADIAL, PANEL.

●

AIR CONDITIONING UNITS

BLAST COOLING COILS

BLAST HEATING COILS

COMFORT COOLERS

UNIT HEATERS

●

Oil Coolers

●

Combustion Engine Radiators

●

Kramer System

(Balance Loader)

KRAMER TRENTON CO.

Trenton, N. J.

Corrosion Resisting and Heat Resisting Steels

The new Tables of Data on Chemical Compositions, Physical and Mechanical Properties of Wrought Corrosion Resisting and Heat Resisting Chromium and Chromium Nickel Steels, published recently by the American Society for Testing Materials, have been under development for many months by ASTM committee A-10, with data contributed by a number of manufacturers and users of stainless steel.

An effort has been made to give the data in condensed form and to cover material in widest commercial usage. The first part pertains to wrought chromium steels, 4 to per cent, 8 to 10 per cent chromium, etc., while the second part covers wrought chromium nickel steels up to 25 per cent chromium, 20 per cent nickel. All told, there are 2 extensive but compact tables and 26 charts and curves covering important data such as chemical composition, physical properties, forging and heat treating practices, and mechanical properties of steels. There is information on creep characteristics and short time tensile properties. This latest publication is the third in the series on stainless steels issued through the work of the society—the first two having been published in 1924 and in 1930.

Copies of the 44 p. pamphlet can be obtained from the ASTM headquarters, 260 S. Broad St., Philadelphia, Pa., for $1.25.

National Dust Explosion Codes

Under the title National Fire Codes for the Prevention of Dust Explosions, 1943, the NFPA has recently published a 160 p. book which includes the 15 American standard codes, a statement of the fundamental principles of dust explosion prevention in industrial plants, and a record of some 780 dust explosions which have occurred in the United States.

Among the subjects for which codes are included are manufacture of aluminum bronze powder; coal pneumatic cleaning plants; pulverized fuel systems; flour and feed mills; terminal grain elevators; country grain elevators; pulverizing systems for sugar and cocoa; sulfur dust explosions and fires; wood flour manufacturing establishments; woodworking plants; and suggested good practices for the application of suction and venting in grain elevators and storage units. Also included is a standard method of using carbon dioxide or other inert gas for the prevention of explosions and fires.

All codes are purely advisory as far as the NFPA is concerned. They have great influence, however, because after their adoption by the association they are largely used as the basis of state and municipal legislation and fire insurance requirements.

The National Fire Protection Association, 60 Batterymarch St., Boston, Mass., is the publisher. Cost of this book is $1.00.

WPB Issues Orders On Fans and Copper

Order L-280 of the War Production Board, issued last month, prohibits acceptance of fan and blower orders after February 28 and delivery after March 31, unless orders are approved. Exceptions are repair parts not exceeding $500 for a single fan, or 50 per cent of the original sales price, whichever is less, and repair of actual breakdown.

Copper order M-9-c, as amended February 26, makes clear that it does not govern products controlled by certain other L and M orders, whether or not the orders in question have been amended or re-issued since the original issuance dates. Restrictions on the use of copper in air conditioning and refrigerating equipment are altered to conform more closely with provisions of other WPB orders. Ferrules, a type of fitting for use with galvanized or lead pipe, are included among the permitted items for water supply and distribution systems.

DIRTY FILTERS can ruin the efficiency of the best air-conditioning system made....

0-1 .2 .3 .4 .5
HAYS

THIS Hays Air Filter Gage gives a constant check on Air Filter conditions. It prevents changing filters sooner than necessary and warns when they are clogged with dirt.

The Hays Air Filter Gage is permanently and easily installed — nothing to get out of order. Will last as long as the duct work. Write 990 Eighth Avenue, Michigan City, Ind., for special Bulletin No. 40-278.

The HAYS CORPORATION
SINCE 1907
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

APPLY WITH BRUSH, TROWEL OR SPRAY

A SURE CURE

NoDrip ● This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance and can be painted any color. A gallon covers about 30 feet of 1" O.D. pipe. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House. Write for **NoDrip Handbook.**

J. W. MORTELL CO.
Technical Coatings Since 1895
512 Burch Street, Kankakee, Illinois

GREEN LIGHT FOR INDUSTRY

***SARAN PLASTIC PIPE, TUBING, FITTINGS**

SARAN by HODGMAN is a tough thermoplastic specially made to replace strategic materials. It is adaptable for use under high working and bursting pressures and is resistant to most chemicals. Its ease of handling makes it extremely valuable in installations requiring the transport of oil, gas and corrosive chemicals.

*Pat. No. 2160931

Send FOR COMPLETE INFORMATION SHEET AND FREE SAMPLE

HODGMAN RUBBER CO.
FRAMINGHAM, MASS.

NEW YORK 261 Fifth Avenue
CHICAGO 412 South Wells St.
SAN FRANCISCO 121 Second St.

THESE 3 Westco ADVANTAGES MEAN IMPORTANT SAVINGS IN YOUR PUMPING JOBS!

TWO-STAGE PERFORMANCE AT SINGLE-STAGE COST

▶ Because of the unique turbine design of Westco Pumps, a *single*-stage Westco will continuously supply high operating pressures that would require a *two*-stage centrifugal pump. Thus, Westcos save on *first* cost...on *operating* cost...*on maintenance!*

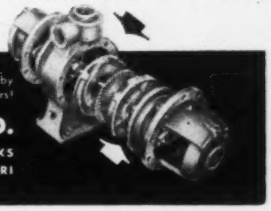
PERMIT FUTURE EXPANSION OF SYSTEM

▶ Westco operating characteristics are such that additional outlets can be handled with *decreasing* horsepower requirements... whereas centrifugals would require *additional power* to maintain operating efficiency. In this way, Westcos reduce *both* cost of expansion and cost of operation if future additions to system become necessary.

PROVIDE STANDBY PROTECTION AT LOWEST COST

▶ Westco's *renewable liner* feature eliminates need for an entire separate pump assembly for safe standby protection. By simply keeping an extra liner assembly on hand, Westcos can be quickly and economically renewed at a *fraction* of ordinary cost.

But get the full Westco story of peak performance at unusually low installation and operating costs before you invest in ANY pump equipment. Ask your Westco dealer — or write direct!



On Westco Pumps, wear and corrosion are taken by *renewable* liners. To renew pump, simply renew liners!

WESTCO-POMONA PUMP CO.
DIVISION OF JOSHUA HENDY IRON WORKS
2621 LOCUST AVENUE, ST. LOUIS, MISSOURI

AIR CONDITIONING ANALYSIS

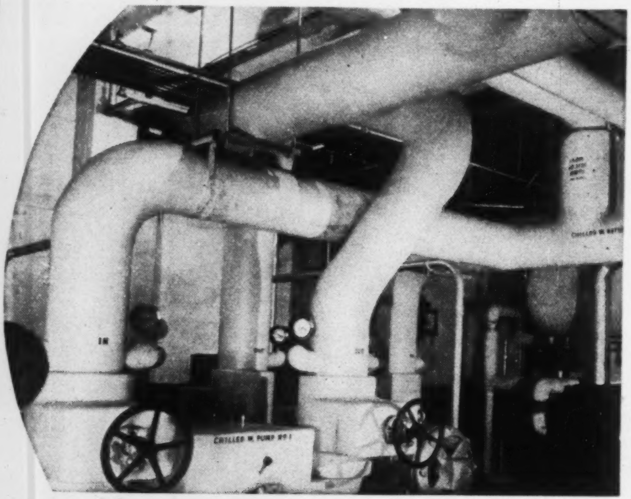
By William Goodman

One of the country's leading experts on air conditioning presents the first comprehensive discussion of the science of changing the condition of air. It includes all information of use to the practicing engineer engaged in refrigeration, temperature control, drying, etc.

Complete sets of psychrometric tables, accurately calculated, cover all barometric pressures from 22 to 32 inches of mercury in addition to the standard pressure of 29.92. Seven charts, including the water-air chart, also usable for different barometric pressures, cover the entire range needed in air conditioning.

455 pages **$6.00**

THE MACMILLAN CO., 60 FIFTH AVE., NEW YORK



Mundet Cork Pipe Covering is made of 100% pure cork, which, due to its low conductivity, holds power costs to the minimum. Its high efficiency permits precise control of low temperature regardless of climate or season • Cold lines, low-temperature ducts, the walls, floors and ceilings of refrigerated rooms should be adequately protected by Mundet Cork Insulation in the form of Cork Pipe Covering and Corkboard • For test data, showing what Mundet Cork Insulation means in savings and operating efficiency, write to Mundet Cork Corporation, Insulation Division, 65 South Eleventh Street, Brooklyn, New York.

MUNDET CORK INSULATION
CONSERVES LOW TEMPERATURE

Heat Transfer by Natural and Forced Convection

The Engineering Experiment Station, Purdue Univers Lafayette, Ind., has published a bulletin (identified as search series No. 84) on heat transfer by natural forced convection. It comprises a series of lectures p sented at Purdue by Allan P. Colburn, professor of che ical engineering at the University of Delaware.

Professor Colburn's four lectures covered an introducti to convection, free convection, forced convection, and app cations to the design of heat exchangers. Thus, it can seen that the bulletin is of great value to the many eng neers who are concerned with the problem of heat transfe

Copies of this 63 p. bulletin may be obtained from Pur University for 25c each.

Pipe and Tube Bending

A 29 p. booklet entitled Pipe and Tube Bending, whi was recently published, presents a set of original tables the rapid calculation of any bend with a minimum of err The author, K. W. Knutson, presents center line and "gai values which he has tabulated in order to permit finishi bends without taking the work from the machine or usi a full scale layout.

The publisher of this booklet is the Cornell Mariti Press, 350 W. 23rd St., New York, N. Y., and the price the publication is $1.00.

Boiler Conversion Parts

The retail trade and services division of the Office Price Administration has issued a service trades bullet No. 5 dated January, 1943, on boiler conversion parts. T bulletin explains the revised maximum price regulati No. 236 which affects heating establishments in 17 easte states and the District of Columbia. Those who wish obtain copies should request them of their OPA region offices and not from Washington.

The bulletin explains the higher parts prices allowed encourage conversion from oil, discusses the conversi parts affected, and gives ceiling prices for parts as well information on services and extra charges, invoices a records, prohibited practices, etc.

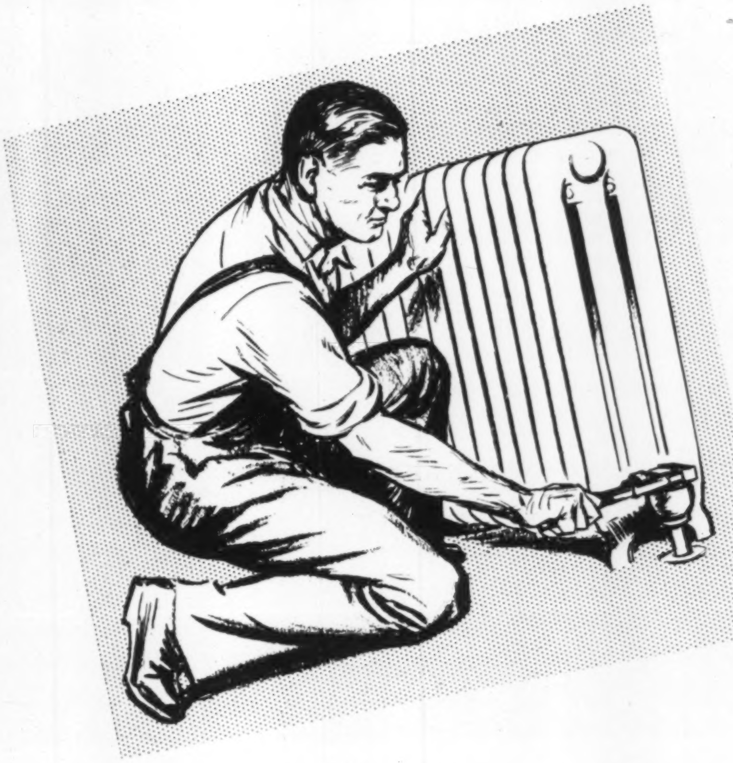
Refrigeration Available for War Use Is Listed

A nationwide survey of 1506 refrigeration and air co ditioning compressor installations by the York Ice Machi ery Corp. in 1000 civilian establishments reveals that mo than 90 per cent of this equipment is available for re-us by the armed forces and war industries. The survey, com piled into a 50 p. printed report, was undertaken by th company to assist the government in the program to loca and convert nonessential in-use refrigeration machinery war needs. All compressor installations listed are of th "Freon" type and have been installed since 1932. Fifty pe cent of the equipment, the survey reports, is less than fi years old and individual plant capacities range from 40 2000 tons, including both reciprocating and centrifuga compressors.

The equipment has been classified by compressor size a by location. Capacity ratings for all compressors are liste together with a quick reference index listing the numbe of compressors of each size installed in various bran territories.

All 11 headquarters branches of the company, includin 28 sub-branches and 123 distributor outlets, took part the survey. At the same time, York announced that a na tional service organization has been set up in Washingto D. C., to cooperate with the government in speeding up th work of transferring equipment to war use when the pr gram gets under way.

Let this be your contribution to Victory: Make your heating equipment serve longer by good care . . . Conserve fuel by promptly replacing worn-out or inoperative parts.



How to get full heat from every Radiator

To get full heat from radiators ample steam must reach them . . . steam must be held until condensed . . . air and water must be removed. For these results, inspect regularly and:

(1) Make sure radiator supply valves are open. (An occasional drop of oil on valve stem makes them open easier and preserves packing.) Worn-out seat discs and packing should be replaced.

(2) Remove obstructions from front and top of radiators. Packages, clothing, etc., on radiators reduces their heat output.

(3) Take out trap interior *when cool* and remove dirt and scale. Wipe trap seat and valve clean with rag or waste dipped in kerosene.

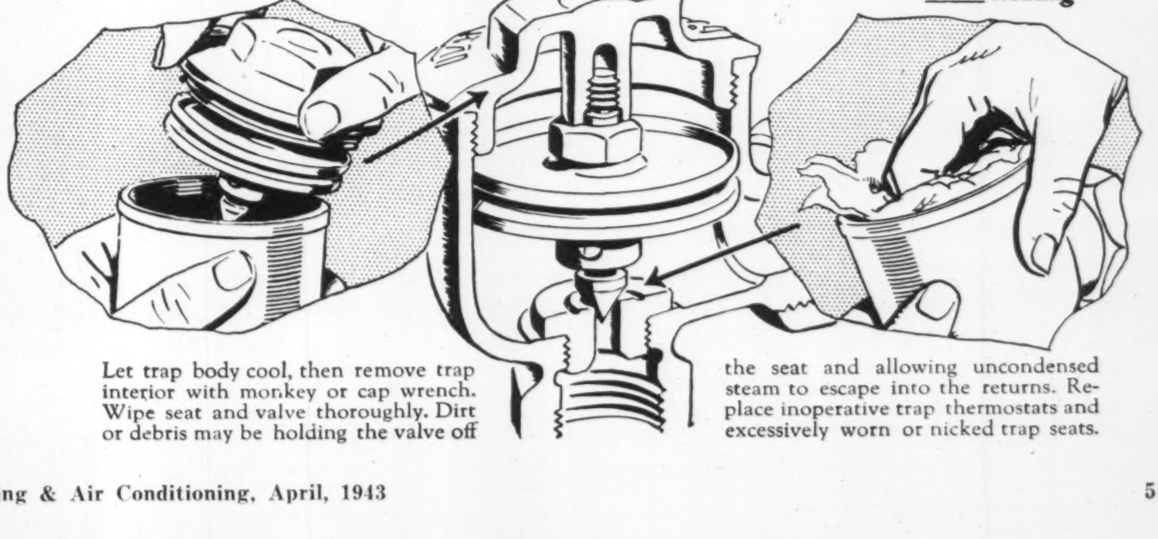
(4) Replace inoperative trap thermostats and excessively worn or nicked trap seats.

Your nearest Webster Representative will tell you how to detect inoperative traps . . . look in your telephone book or write us for his address. When trap interiors must be replaced, use genuine Webster Thermostatic Assemblies —they can be inserted in old trap bodies without disturbing piping. All work can be done right on the job.

WARREN WEBSTER & CO., Camden, N. J.
Pioneers of the Vacuum System of Steam Heating :: Est. 1888
Representatives in principal cities :: Darling Bros., Ltd., Montreal, Can.

ARMY E NAVY

Webster
Steam Heating



Let trap body cool, then remove trap interior with monkey or cap wrench. Wipe seat and valve thoroughly. Dirt or debris may be holding the valve off the seat and allowing uncondensed steam to escape into the returns. Replace inoperative trap thermostats and excessively worn or nicked trap seats.

The **Biggest** Construction Volume Today is in *People's heads*

Although there are no men, materials or time to spare for any but essential structures today, there's probably more *mental* building going on than ever before.

Homes, plants, schools, hospitals, and churches, deferred till peacetime, are now taking shape in people's heads—for they are an essential part of the pattern of living America is fighting to preserve.

In connection with this planning, Radiant Heating is receiving a lot of attention, and is the source of many questions. These can best be answered in terms of actual experience, and Byers has a large reservoir of such reports from users. For instance:

. . . The man who reported that Radiant Heating saved his furniture; his dogs found the Radiant-Heated floor more comfortable to sleep on.

. . . The man who "never tired" of searching for the cold-spots present in all other houses . . . but absent in his.

. . . The young couple who luxuriated in the opportunity, provided by Radiant Heating, of doffing shoes as well as wraps at their front door.

. . . The gloating householder whose friends had fuel bills of $20 and $22, while his (in a comparable house, Radiant Heated) was only $13.13.

. . . The man whose wife "found to her amazement she had to turn the thermostat down day after day . . . we now find a 60 degree setting most favorable."

. . . The employer who reported (1) fewer creaking joints among old employees, and (2) lowered clothes-pressing bills, as two of many dividends from Radiant Heating.

These are not cited as typical, but merely to suggest the range and variety of the case histories in file. As a help to building counsellors who are being asked about Radiant Heating, a "Question and Answer" section is included in our technical bulletin, "Byers Wrought Iron for Radiant Heating." Also included is information on figuring and installing jobs, and data on the thermal qualities, corrosion resistance, and workability of wrought iron. Wrought Iron has become synonymous with Radiant Heating because of its unusual combination of these essential qualities. May we send you a bulletin?

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

BYERS WROUGHT IRON

Byers

GENUINE WROUGHT IRON

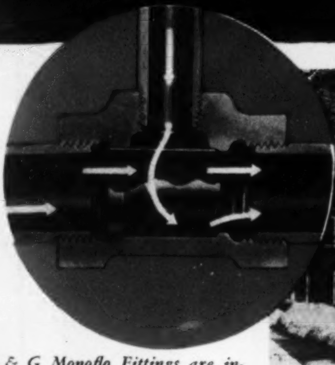
TUBULAR & HOT ROLLED PRODUCTS

ELECTRIC FURNACE ALLOY STEEL
OPEN HEARTH ALLOY STEEL
CARBON STEEL TUBULAR PRODUCTS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

One PIPE DOES THE WORK OF *Two*

RET↓URN
MON FLO
PATENT NO. 1883271

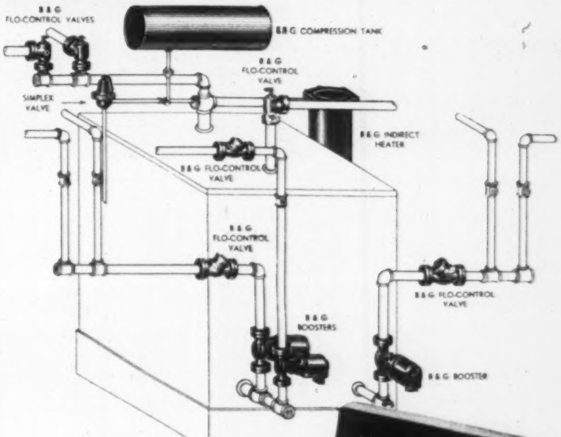


B & G Monoflo Fittings are installed in place of the usual tee connection between main and riser. A balanced distribution of water to each radiator is achieved by the patented internal construction, but without excessive resistance.

AT GREAT LAKES NAVAL TRAINING STATION

These officer residences are a few of many Great Lakes buildings heated with forced hot water and using a B & G Monoflo *single* main piping system. The ability of this type of system to furnish heat in amounts at all times equal to the heat loss, keeps indoor temperature at the comfort level, regardless of the weather.

Typical boiler connections for 3-zone B & G Monoflo System.



Today's pressing need for conservation of war-vital materials is well served by an expertly engineered little device now famous as the B & G Monoflo Fitting. A genuine advance in heating equipment design, it permits the use of a *single* main instead of two when installing a forced hot water heating system. This simplification, plus the great reduction in pipe sizes made possible by mechanical circulation, materially cuts the weight of metal required to give the comforts of *radiant* hot water heat.

B & G Monoflo Fittings, without introducing excessive resistance, assure a smooth and uniform distribution of hot water to the heating units, whether above or below the main. Balancing of individual radiators is eliminated.

A B & G Monoflo System is simplicity itself to design. It offers a neater installation, with piping easier to conceal. It has no size limitations—buildings requiring as much as a quarter-million sq. ft. of radiation are successfully using it. The system is made to order for zoning, the modern way of obtaining better heat control and minimum use of fuel. Complete design information is given in the B & G Hand Book—send for your copy.

B&G

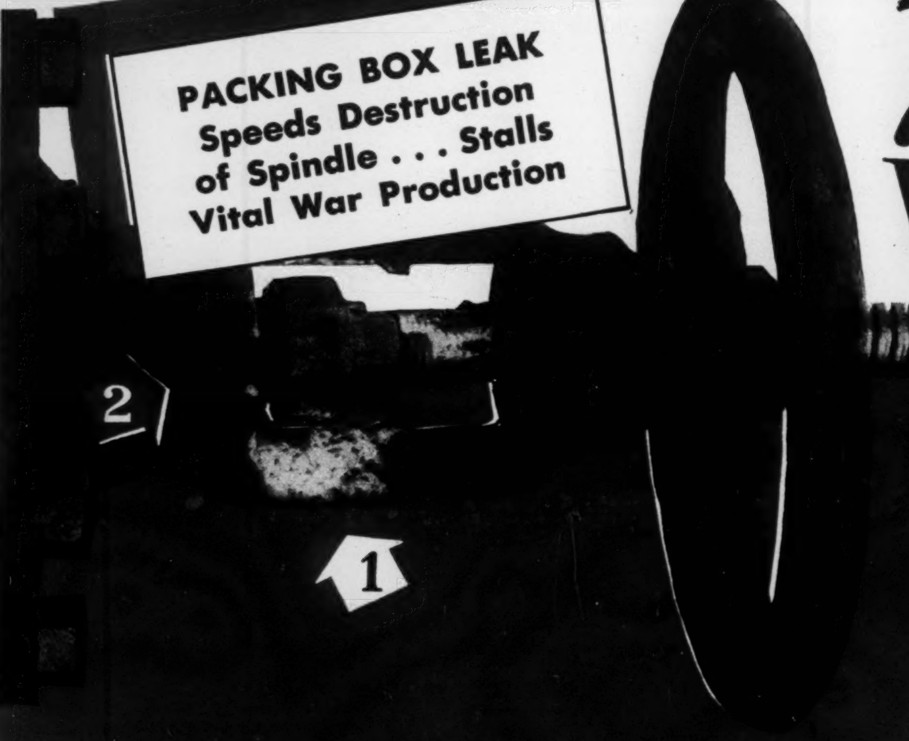
BELL & GOSSETT COMPANY.

MORTON GROVE, ILLINOIS (Suburb of Chicago)
Canadian Licensee: S. A. Armstrong, Ltd., 115 Dupont St., Toronto

MONOFLO SYSTEM

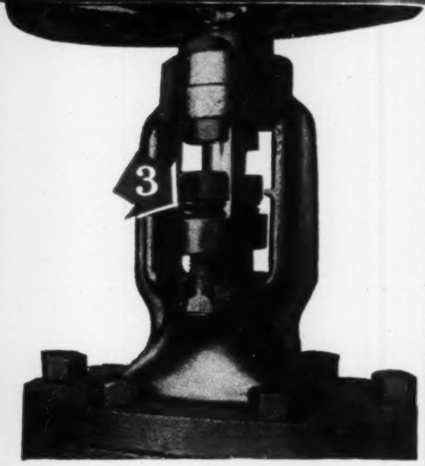
B&G HANDBOOK

Complete instructions for designing B & G Forced Hot Water Heating Systems.



PACKING BOX LEAK
Speeds Destruction
of Spindle . . . Stalls
Vital War Production

Prevent Valve Failure *before it starts!*



A neglected leak in the packing box of the valve illustrated corroded the spindle so badly it had to be replaced.

The crusted scale (1) indicates that the leak was apparent for a long time. It is also evident that the gland has been tightened to the limit (2) by someone who believed he was checking the leak by compressing the packing. Instead, the packing was simply jammed into a hard, dry mass.

While the spindle was being replaced, it was necessary to close the main steam line and interrupt production in a plant humming with war work.

Waste of production hours through preventable valve failure is inexcusable today, since delay in the delivery of war materiel may eventually spell defeat for our armed forces. Equally serious is the waste of critical metals by needless replacement of valve parts. Such waste can be effectively controlled by an adequate program of valve conservation.

Make sure that valves are inspected regularly – that worn parts are repaired or replaced before a valve destroys itself. Maintenance workers should be instructed thoroughly. Valves for new installations should be selected carefully, and properly installed.

Recommend an effective system of valve conservation to the plants you serve. Jenkins Engineers will provide any assistance you need upon request of details of present valve problems.

Jenkins Bros., 80 White St., New York, N. Y.; Bridgeport, Conn.; Atlanta, Ga.; Boston, Mass.; Philadelphia, Pa.; Chicago, Ill. Jenkins Bros., Ltd., Montreal; London, England.

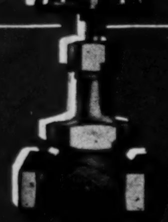
Packing Box Leaks are Easily Corrected by Proper Maintenance

Frequent inspection will reveal the tell-tale drip where the stem enters the packing box, which indicates faulty packing. First, tighten packing box by applying ordinary effort to gland nuts. Then if leak continues, the valve should be repacked.

When repacking, all old packing should be removed and replaced with new material of the proper type. Leaks often result from wrong packing.

If valves are used infrequently, or if internal conditions are unfavorable, it is advisable to keep a live load on the packing. Steel springs with two or three coils, installed between the packing nuts and gland (see 3), will keep packing compressed and compensate for varying conditions. Packing box leaks are just as troublesome in small valves as in large. Excessive tightening of the packing nut will not remedy the condition when repacking is necessary, and may damage the packing nut.

Smooth spindles are important to prevent leaks and preserve life of packing. Spindles should be kept clean and protected from scratching and scoring.



JENKINS VALVES
SINCE 1864
For every industrial, engineering, marine and power plant service . . . in Bronze, Iron, Cast Steel and Corrosion Resisting Alloys . . . 125 to 600 lbs. pressure

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1943 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.

Encased Coil Patents

No. 2413—Milner Noble, president of Aerofin Corp., 410 S. Geddes St., Syracuse, N. Y., stated March 5 that the consent decree entered into by the corporation with the Department of Justice provides for free licenses under the Soule patent No. 1,597,733, known in the heating and ventilating industry as the "encased coil" patent, but that free licenses under this patent had voluntarily been granted competitors since last July.

"Aerofin Corp. does not admit any guilt in the decree," Mr. Noble said, stating that the decree had been accepted in order to avoid legal proceedings which might seriously interfere with the corporation's activities, now devoted 100 per cent to war work.

The Department of Justice complaint charged anti-trust law violation in controlling and fixing prices of encased finned coils by means of patent licensing and agreements with manufacturers and distributors.

Wartime V Belt Drives

No. 2414—A new plan to save 250,000 lb of crude rubber this year has been announced by Walter Geist, president of Allis-Chalmers and inventor of the multiple v belt drive. The program calls for "wartime drives" using shorter center distances and larger sheaves on all new applications made in 1943. "The plan is geared to present design limitations," says Mr. Geist, "and only slight changes in dimensions are necessary to save a quarter-million pounds of crude rubber."

Although engineering of individual v belt drives has been governed in the past largely by such considerations as convenience, habit, and machine design, today the most important consideration is the saving of rubber for our dwindling stockpile, Mr. Geist points out. However, he adds, the plan should not be regarded as a temporary wartime expedient, for the increases are sound and practical—in line with a long range trend to larger diameters.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Aluminized Steel

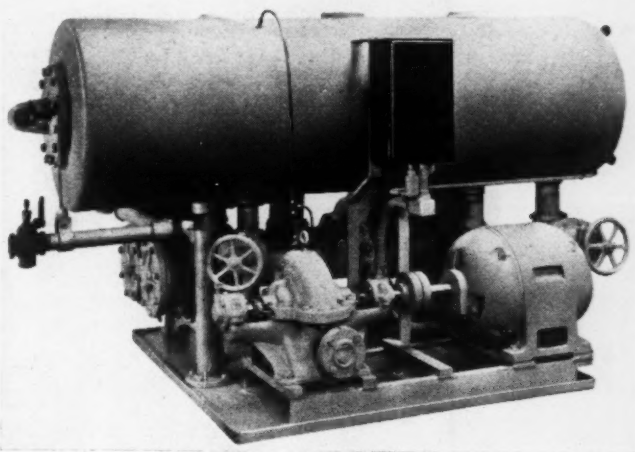
No. 2415—Aluminized steel, a new specialty sheet metal, has been developed for use in products requiring exceptional resistance to heat and corrosion, states the maker. This aluminum coated sheet, with a mild steel base, combines the surface advantages of aluminum with the strength of steel.

Corrosion resistance of the aluminized steel surface is equal to that of an aluminum sheet, it is said. It withstands temperatures up to 1000 F and the coating will not peel or flake in moderate forming or drawing operations. Paint will hold better than on ordinary galvanized sheets, yet for most uses the unpainted surface is satisfactory.

After the war it will be available in a finish that can be buffed to a bright luster for exceptionally good appearance and reflectivity.—The American Rolling Mill Co., 703 Curtis St., Middletown, Ohio.

Condensate Return Units

No. 2416**—A condensate return unit of growing importance consists of an electrically driven centrifugal pump, a steam driven pump, and a receiver assembled on a common base with complete controls for automatic or manual operation on either steam or electric power. This unit is of special value in hospitals or plants where operation must not cease when current fails, the manufacturer states. Exhaust steam may be utilized by this unit.



Due to the specialized nature of operation, space, and construction requirements, this new unit must be engineered for the particular installation considered, but it is an addition to a standard line of condensate return units.—Walter H. Eagan Co., 2336-38 Fairmount Ave., Philadelphia, Pa.

Sealing Compound

No. 2417**-A new joint sealing and anti-seize compound known as "Bestolife lead seal No. 270" contains a high percentage of finely powdered metallic lead. It is intended to lubricate threads as a joint is made up to create a tight, leakproof mechanical joint and to prevent seizure and galling. The compound is nonhardening and nonexpanding.

It may be used on fittings in the assembly of burners and on pipe lines carrying fuel oil, gas, air, ammonia, etc.

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [4-43]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature.

(*Circle each number in which you are interested*):

2413	2414	2415	2416	2417	2418	2419	2420	2421	2422
2423	2424	2425	2426	2427	2428	2429	2430	2431	2432
2433									
4397	4398	4399	4400	4401	4402	4403	4404	4405	4406
4407	4408	4409	4410	4411	4412	4413	4414	4415	4416
4417	4418	4419	4420	4421	4422	4423	4424	4425	

Name.......................... .. Title...........

Company ....

Address ....

City.............................. State...........

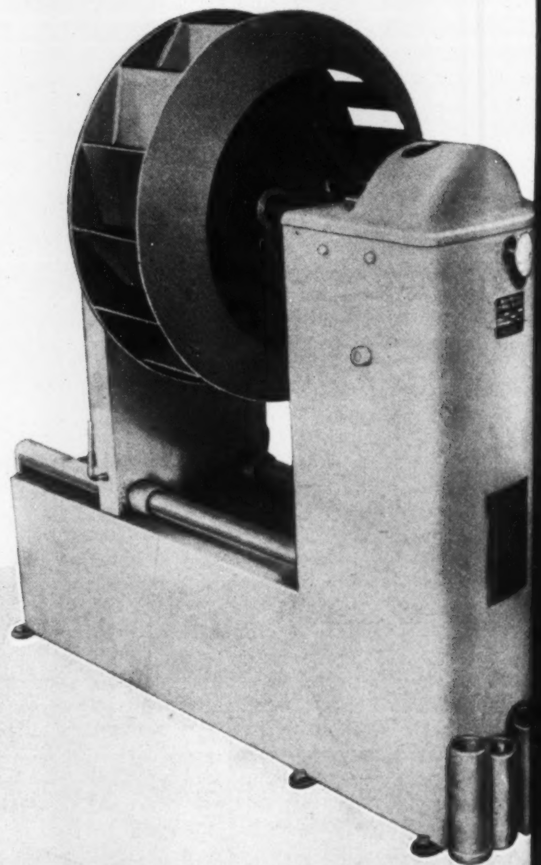
PERFECT BALANC

Means Perfect Fan Performanc

In this day of super-production, every piece of equipment must be designed and constructed to deliver maximum performance . . . giving assurance of faultless operation that will eliminate costly shutdowns. . . . . The New York Blower Company employs several of the most modern balancing machines . . . to give the users of their fans and blowers assurance that the fans they buy are balanced perfectly in every respect . . . for perfectly balanced fans last longer and have greater efficiency. Balancing eliminates wear on essential parts, eliminates noises in the system, and gives maximum blower efficiency. If your priority ratings permit . . . and you need new blower equipment, investigate The New York line of fans. They will do a better job of delivering air when and where you want it . . . and effect many economies in the system's operation.

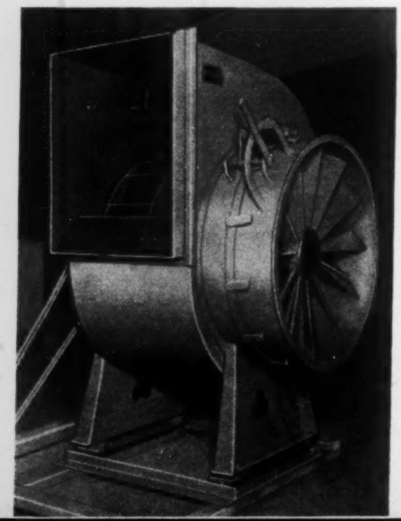
THE NEW YORK BLOWER CO.

. . . . . New York Blower Wheels Have Dynamic Balance!



Type -ME- Fans Have Many Advantages!

Type -ME- High Speed, non-overloading, reversible housing fans, equipped with the famous Vari-Volume Inlet Damper are superior in many ways. The damper controls the volume of air on the inlet side of the fan; either manually or automatically, without disturbing the fan efficiency or the smooth flow of air throughout the system.



SOME TYPICAL USERS:

Anheuser-Busch
Armour & Co.
Bendix Corp.
Burroughs Adding Machine
Carnegie-Illinois Steel
Chevrolet
Corn Products
Crane Co.
Curtiss Wright
Detroit Stoker
Fairbanks Morse
Fansteel Metallurgical Corp.
Ford Motor
Fruehoff Trailer
General Electric

General Motors
Hercules Powder
Imperial Paper & Color
Inland Steel
International Harvester
Kelsey Hayes Wheel
Liggett & Myers Tobacco
R. C. Mahon
Mesta Machine
Molybdenum Corp of Amer.
Morrell Packing
Morton Salt
Oliver Iron & Steel
Packard Motor Car
Paramount Textile

Pennsylvania Salt
Phelps Dodge
Phoenix Glass
Republic Steel
Pressed Steel Ca
Procter & Gambl
Scully Steel
Shell Oil
Signode Steel
U. S. Gypsum
Western Electric
Whiting Corp.
Wrigley, Wm. & C
Wurlitzer Co.

Write for complete information NO

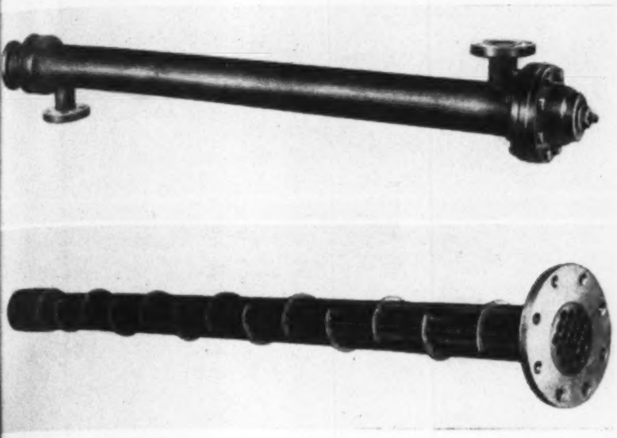
The NEW YORK BLOWER COMPANY

GENERAL OFFICES
32nd STREET & SHIELDS AVENUE · CHICA
FACTORIES at LAPORTE, IND. and CHICAGO

Specifications covering the use of this compound on aircraft nd naval equipment are available.—I. H. Grancell Co., 1601 E. Nadeau St., Los Angeles, Calif.

Standardized Heat Exchanger

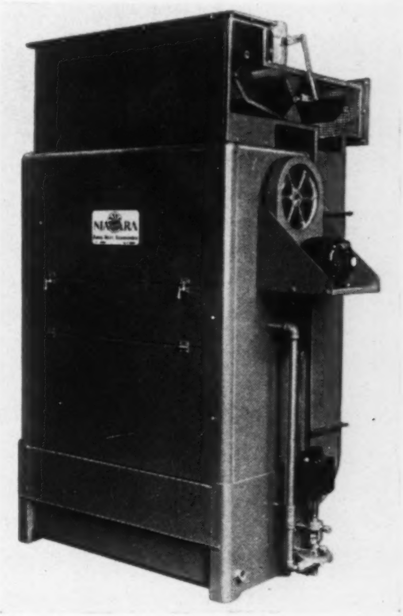
No. 2418—The "Shellfin", a standardized heat exchanger suitable for most uses and built on a production basis, is a ew product which was recently announced. With only minor changes in its basic construction, such as baffle spacing and length combinations of units, the unit can be used or many forms of heat exchange between two fluids in edium temperature ranges where temperature of one fluid aterially exceeds that of the other. It may be adapted to ooling, heating, condensing and evaporating processes.



The standardized construction eliminates much usual preliminary engineering; having standardized performance and ressure curves, unit selection can be made easily, says the anufacturer.—Downingtown Iron Wks., Wallace Ave., Downingtown, Pa.

Automatic Temperature Control for Evaporative Heat Exchanger

No. 2419—A new method of automatic temperature control for the "Aero" heat exchanger, used for cooling industrial liquids, is based on controlling the amount of outside air passed through the evaporative cooling chamber rather than altering the flow of liquid being cooled. Accuracy is improved, with the cooling effect directly proportioned to load changes, giving a modulated, nearly straight line temperature control with no "hunting" action, says the maker. Water savings are increased and when the heat exchanger is used to cool oils or compounds, there is no settling of solids, restricted flow, or clogging of tubes to interrupt operations, it is said.

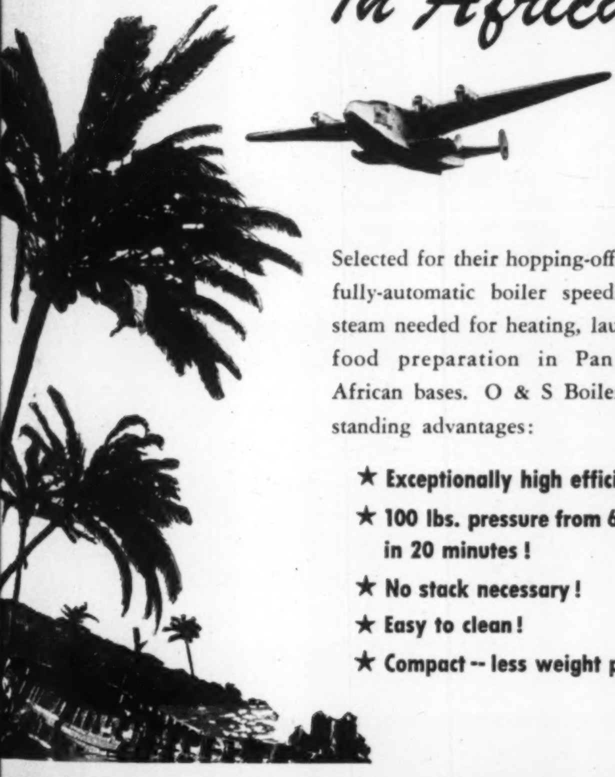


The apparatus comprises a recirculating air duct to which outside air is admitted by dampers controlled by a thermostat in the liquid line where it is always in contact with the full flow of the liquid being cooled.—Niagara Blower Co., 6 E. 45th St., New York, N. Y.

In Africa - NEW O&S BOILERS

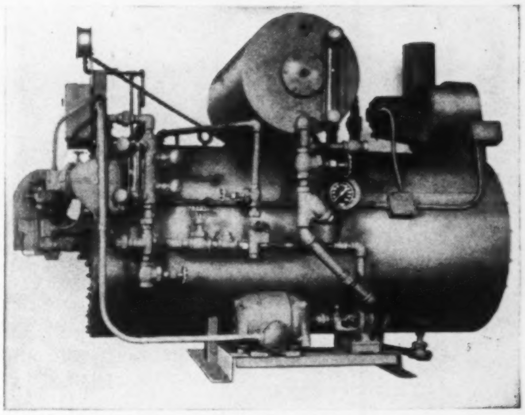
are pioneering

with PAN-AMERICAN AIRWAYS!



Selected for their hopping-off points—this fully-automatic boiler speedily develops steam needed for heating, laundering and food preparation in Pan American's African bases. O & S Boilers offer outstanding advantages:

★ **Exceptionally high efficiency!**
★ **100 lbs. pressure from 60° water in 20 minutes!**
★ **No stack necessary!**
★ **Easy to clean!**
★ **Compact -- less weight per H. P.!**

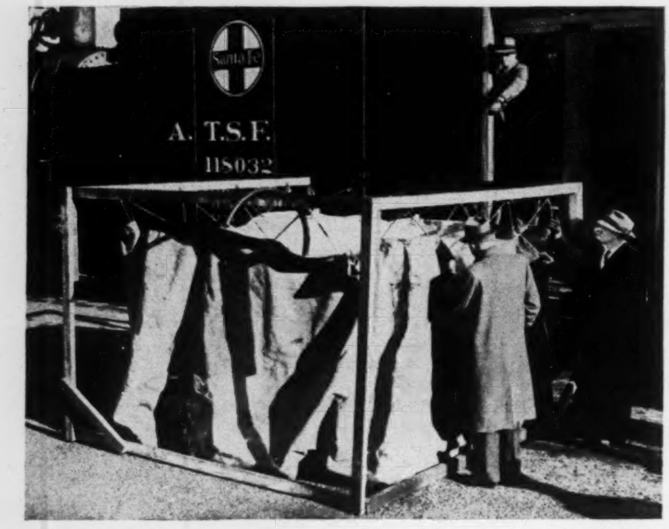


Although developed expressly for U. S. Army use, this unique boiler promises wide application in your industry when Victory makes O & S Boilers again available for all purposes.

ORR & SEMBOWER INC. O&S **Builders of Better Boilers Since 1885**
READING • PENNSYLVANIA

From Box Cars to Tank Cars

No. 2420—The "flexitank" car for carrying liquid cargoes, such as petroleum products, an invention of Mark J. Fields, was demonstrated in the Santa Fe Railway's yards in Chicago recently to the satisfaction of a group of railroad and government officials; the invention consists of converting an ordinary box car to carry liquid cargoes.



The box car is changed to a tank car by dividing the interior into four compartments by means of wooden bulkheads. In each compartment, a canvas container, treated with "Faraprene", a rubber synthetic, is suspended by means of a series of pulleys and ropes.

Each of the canvas tanks has a capacity of more than 3000 gal.

Stratosphere Testing Cabinets

No. 2421—Stratosphere testing cabinets capable of reproducing a temperature range from 100 F below zero to 158 F above are being produced jointly by the York Ice Machinery Corp. and the Tenney Engineering Co. through collaboration of their engineering and factory staffs. The plan, according to officials of the two companies, is designed to "make more widely available the most advanced facilities for stratosphere and temperature testing of flying and communications equipment and instruments." Stratosphere testing cabinets engineered by Tenney will be equipped with specially designed refrigerating equipment built by York.

The cabinets use two stage cascade refrigeration and are equipped with automatic control panels. Specially constructed observation ports are sealed to prevent condensation. To make mechanical adjustment of the apparatus under test, small rotating shafts are installed; these are manually turned from the outside, with the shaft extending through a specially designed pressure seal.

Return Ammonia Cylinders

No. 2422—The War Production Board has urged all users of ammonia to speed the return of their empty cylinders to the manufacturers. Steel is not available for new cylinders, and demands for ammonia in war work are so great that all packages must be utilized to the fullest possible extent.

Manufacturers now have ample stocks of ammonia to take care of emergency needs distributed at key cities over the country, making it unnecessary for plants to keep a reserve supply on hand.

A large cylinder to carry 150 lb of ammonia requires 240 lb of steel, one to carry 100 lb takes 175 lb of steel, and the small cylinder for 50 lb requires 105 lb of steel. Present inventories of cylinders will have to do the job as long as steel is urgently needed for ships, guns, and tanks.—E. I. du Pont de Nemours & Co., National Ammonia Div., Wilmington, Del.

FOR LOW-COST HEATING, QUICK INSTALLATION AND METAL CONSERVATION

DIRECTHERM UNIT HEATERS STOKER-FIRED

It is a self-contained unit and can be installed or moved in a few hours. No duct work, radiators, or pipes are necessary.

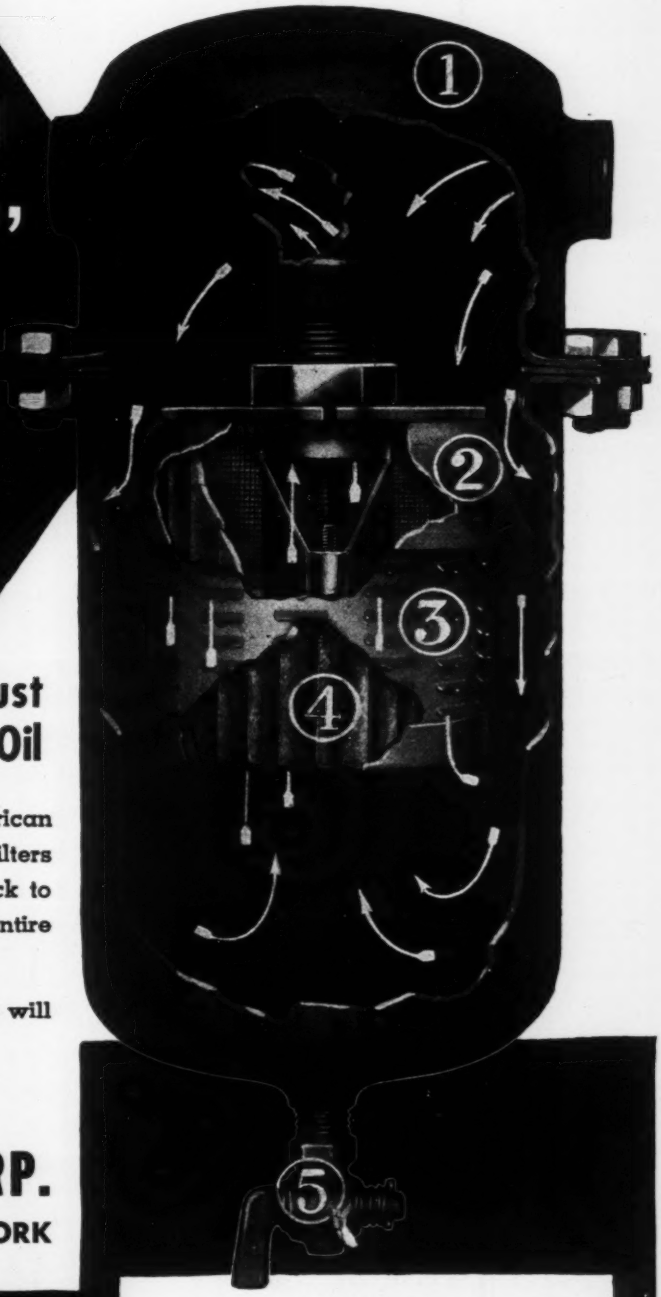
To tend a Directherm requires a minimum of attention. Once the automatic controls are set, they need not be changed. An unskilled man can take care of it ... important in these days of labor shortage.

Made in 6 sizes (300,000-1,700,000 BTU).

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. • ST. LOUIS, MO.

More than a "Separator"

PROTECTOMOTOR PIPE LINE FILTER DELIVERS *Clean* AS WELL AS *Dry* AIR



Rust, Pipe Scale, Dirt and Dust removed in addition to Water and Oil

Repeat orders from hundreds of leading American concerns prove that Protectomotor Pipe Line Filters save money, speed production. Easy and quick to install, Protectomotors have often saved their entire cost in a single month.

Find out how in your operation Protectomotors will increase output, help win the war.

WRITE FOR CATALOG

STAYNEW FILTER CORP.
9 CENTRE PK. ROCHESTER, NEW YORK

Model CPH

Positive Action ★ Exclusive Construction

As air strikes Baffle (2) most water, oil and heavier particles are thrown to sides of Container (1), draining to bottom where excess is drawn off thru Drain Cock (5). Passage of all wet or dry matter is positively prevented by exclusive Feltex dry-type filtering medium in patented Radial Fin Insert (4) in louvred housing (3). Only clean, dry air is delivered.

Air Filter Headquarters

FILTERS FOR PIPE LINE, ENGINE INTAKE AND BUILDING VENTILATION

Temperature Changes Mean Trouble in Unprotected Air Lines

Moisture in compressed air is condensed as the air passes through cold sections of pipe. Unless removed, this water washes out lubrication from air-powered tools, freezes upon expansion in these tools, and causes loss of power or stoppage due to clogging of ports; causes delays and waste at other points of compressed air usage. Staynew Pipe Line Filters (Protectomotors), installed as near point of use as possible, remove condensed water and prevent these troubles.

PROTECTOMOTOR 99 9/10 Per Cent AIR FILTERS

—YOU NEED PROTECTOMOTOR MORE THAN EVER IN WINTER

PETRO
REG. U. S. PAT. OFF

OIL BURNING SYSTEMS
FOR 194?

Today Petro's entire capacities are devoted to war production—burners for war and many items nobody would have expected to come out of an oil burner factory.

But development research can be advanced with no detriment to the war effort, and Petro's engineering corps is working steadily on such things.

Much helpful knowledge already has come from Industry's war effort. Petro systems have carried terrific overloads month after month. Such conditions telescope time for research engineers. Each month of such operation provides data and studies equal to years of peace time.

Similarly, Petro's manufacturing of war materiel has developed much that will be directly beneficial when large scale production of Petro oil burning equipment is resumed. Because no changes in Petro equipment are ever made until ample proof of betterment is established, no specific report can be made now.

So, when Heating Contractors are busy with post-war buildings they can be sure that the Petro oil burning equipment they will have for consideration will deserve a place in those better buildings.

And at that time, qualified Petro engineers will be available to consult and cooperate on the selection, specification and installation of oil-firing equipment that will squarely meet the future's standards of operating efficiency.

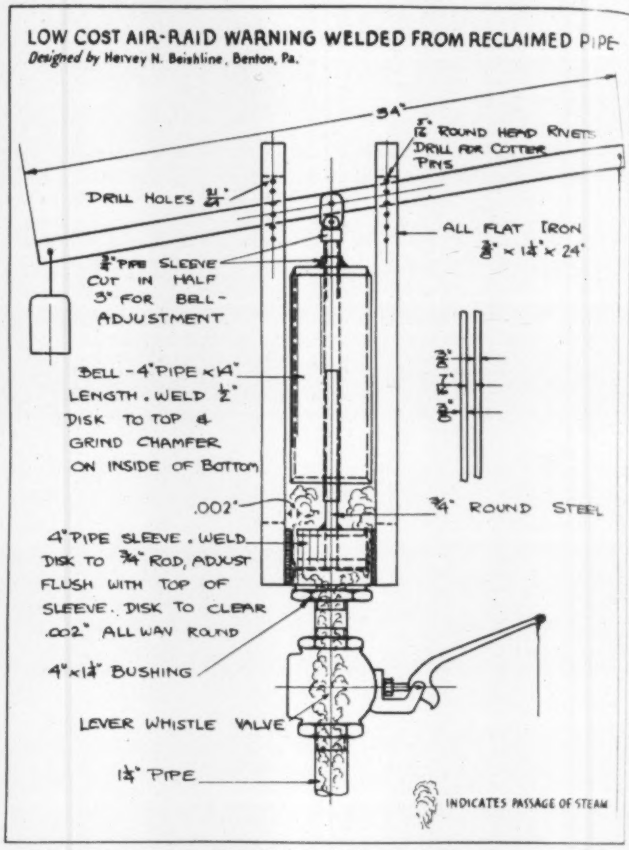
OIL IS AMMUNITION
USE IT WISELY

Full data on Petro Industrial Burners are in our Catalog—see Sweet's or Domestic Engineering Catalog Files—or we will gladly send copies on request.

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD CONNECTICUT

Welded Air Raid Whistles

No. 2423—A method by which any community or company requiring air raid warning equipment can obtain such devices is offered by a device of Hervey N. Beishline, Benton, Pa. The whistle was built entirely from pipe and pipe fittings and was arc welded throughout.


LOW COST AIR-RAID WARNING WELDED FROM RECLAIMED PIPE
Designed by Hervey N. Beishline, Benton, Pa.
54"
5/16" ROUND HEAD RIVETS DRILL FOR COTTER PINS
DRILL HOLES 21/64"
ALL FLAT IRON 3/8" × 1 1/4" × 24"
3/4" PIPE SLEEVE CUT IN HALF 3" FOR BELL-ADJUSTMENT
3/8"
7/16"
3/8"
BELL - 4" PIPE × 14" LENGTH. WELD 1/2" DISK TO TOP & GRIND CHAMFER ON INSIDE OF BOTTOM
.002"
3/4" ROUND STEEL
4" PIPE SLEEVE. WELD DISK TO 3/4" ROD, ADJUST FLUSH WITH TOP OF SLEEVE. DISK TO CLEAR .002" ALL WAY ROUND
4"×1 1/4" BUSHING
LEVER WHISTLE VALVE
1 1/4" PIPE
INDICATES PASSAGE OF STEAM

The "zoom, zoom" bellow of the whistle is accomplished by raising and lowering the weight. When the weight is lowered, the pitch becomes higher, and as it is raised the pitch is lowered. Steam goes through the whistle at all times. The method of operating the warning is to pull the whistle valve wide open; then the wire which is connected to the bell lever is pulled, allowing about 10 sec for complete travel, and then released during an interval of approximately 10 sec. This operation can be repeated as often as desired. The inventor points out that the weight must be sufficient to return the bell lever and wire to normal position.—Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

Industrial Glass Thermometer

No. 2424—A new pressed steel case glass thermometer, originally designed as a means of conserving the copper used in cast bronze cases, also incorporates a number of improvements, according to the manufacturer. It is made so that it is possible to furnish back, side, and oblique angles without using a ball joint.

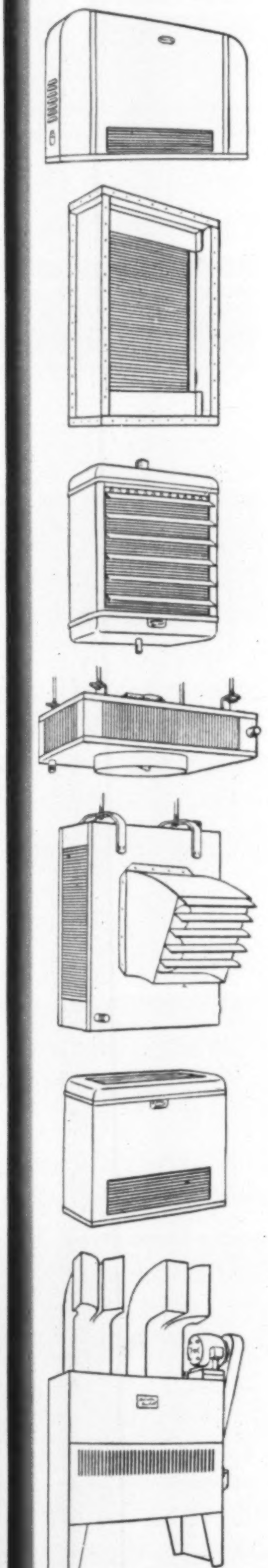
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
AMERICAN

Features include location of scales and tubes to produce high readability, a more legible and better looking scale, a reinforced and practically corrosionproof case, and a method of attaching the screw which holds the cover so that it can never come loose.

The weight is approximately one-third less than the present standard glass thermometer of the same size. The manufacturer states that this thermometer fully meets Navy specification 18-T-7.—Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

TOMORROW is well on its way!

When days of peace and reconstruction come, remember to specify equipment of NESBITT make to answer your heating, ventilating and air-conditioning problems.



NESBITT-MADE EQUIPMENT

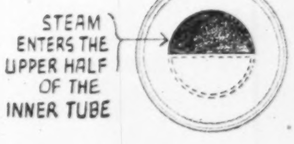
HEATING SURFACE

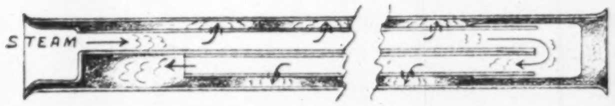
●

NESBITT HEATING SURFACE

● WITH DUAL STEAM-DISTRIBUTING TUBES

● HAS A SPECIAL "DOUBLE TUBE" INSIDE EACH CONDENSING TUBE





● THIS INNER OR STEAM-DISTRIBUTING TUBE HAS ORIFICES DOWN THE ENTIRE LENGTH OF BOTH HALVES AND ASSURES THAT EVEN THE SMALLEST AMOUNT OF STEAM IS DISTRIBUTED UNIFORMLY OVER THE WHOLE LENGTH OF THE SECTION ...

● THIS ELIMINATES TEMPERATURE STRATIFICATION AND PERMITS THE STEAM SUPPLY TO BE THROTTLED IN THE PRESENCE OF SUB-FREEZING AIR WITHOUT THE DANGER OF CONDENSATE FREEZING.....

● THIS SURFACE IS IDEAL FOR CONTINUOUS VALVE CONTROL INSTALLATIONS TAKING OUTDOOR AIR ... AND IT ELIMINATES SEPARATE TEMPERING COILS.

NESBITT

JOHN J. NESBITT, INC., HOLMESBURG, PHILADELPHIA, PA.

Manufacturers of the Nesbitt Syncretizer Heating and Ventilating Unit, Nesbitt Heating and Cooling Surfaces, and Webster-Nesbitt Unit Heaters

The Nesbitt Syncretizer is sold by John J. Nesbitt, Inc., and American Blower Corporation • Nesbitt Surfaces are sold by leading manufacturers of fan-system apparatus • Webster-Nesbitt Unit Heaters are sold by Warren Webster & Company

Economical
WELDOLET
THREDOLET
SOCKET-END WELDOLET

WELDOLETS, ThredOlets and Socket-End WeldOlets are economical because they cost no more—in many cases less—than any other type of fitting for making right-angle branch pipe outlets.

They are economical because they are installed by electric-arc or oxy-acetylene welding—because they reduce installation time by eliminating all cutting, threading, forming and fitting of the main line to install a tee.

They produce leakproof, right-angle welded branch pipe outlets of full pipe strength, either before or after erection of the main line. They reduce the weight of piping systems, eliminate the need for extra braces at the junction. Because of their wide, funnel-shaped intake aperture they improve flow conditions, reduce turbulence and friction to a minimum.

Made for all standard pipe sizes, they are suitable for every type of piping installation and for all commonly used pressures and temperatures. Stock fittings are of drop forged steel, but can be made on special order of Everdur, Monel, brass, wrought iron, Toncan Iron, etc.

Branch Pipe Outlets
with
BONNEY
WELDOLETS
THREDOLETS
SOCKET-END WELDOLETS

Write for Bulletin WT31 giving full details of all their advantages.

Forged Fittings Division

BONNEY FORGE & TOOL WORKS, Allentown, Pa.

WELDOLETS·
TRADE MARKS - REG. U.S. PAT. OFF.
THREDOLETS
Welded Outlets for Every Piping System

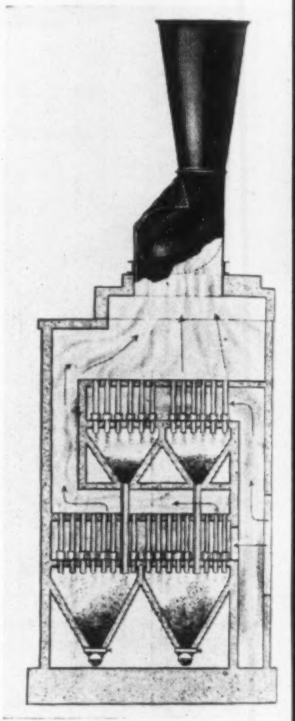
Thermostatic Steam Trap and Packless Radiator Valve

No. 2425—Two new "Victory" products, a thermostatic steam trap and a packless radiator valve, supersede the respective cast brass body types to conform to the simplification program of the War Production Board.

Motive element of the trap is a phosphor bronze diaphragm. The trap has female inlet and outlet connections with left hand thread inlet and right hand thread outlet. The three sizes—for 200, 400, and 700 sq ft—are furnished in the angle pattern only. Construction features include a renewable brass needle and seat.

The valve also is furnished in the angle pattern only. Construction features include an all metal packless seal consisting of two spring steel wafers which form a perfect seal against the annular collar on the valve stem. It is made in two sizes, ¾ and 1 in.—James P. Marsh Corp., 2073 Southport Ave., Chicago, Ill.

Ceramic Tubes in Dust Collectors

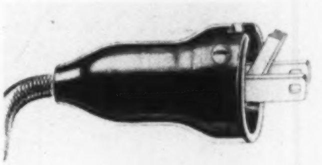


No. 2426—To save vital steel, tubes of special fire clay are now used in "Thermix" ceramic tubular dust collectors.

It is stated that these tubes are sufficiently thick and rugged to be proof against fracture and breakage from normal handling or from changes in temperature, yet they weigh no more than the steel tubes previously used. The ceramic tubes are mounted in a concrete or brick casing above concrete bins.

Being made of nonpriority materials, concerns who have been unable to obtain preference ratings which would enable them to install a dust collector built of steel, will now be able to obtain prompt delivery of this new apparatus, says the maker.—Prat-Daniel Corp., Port Chester, N. Y.

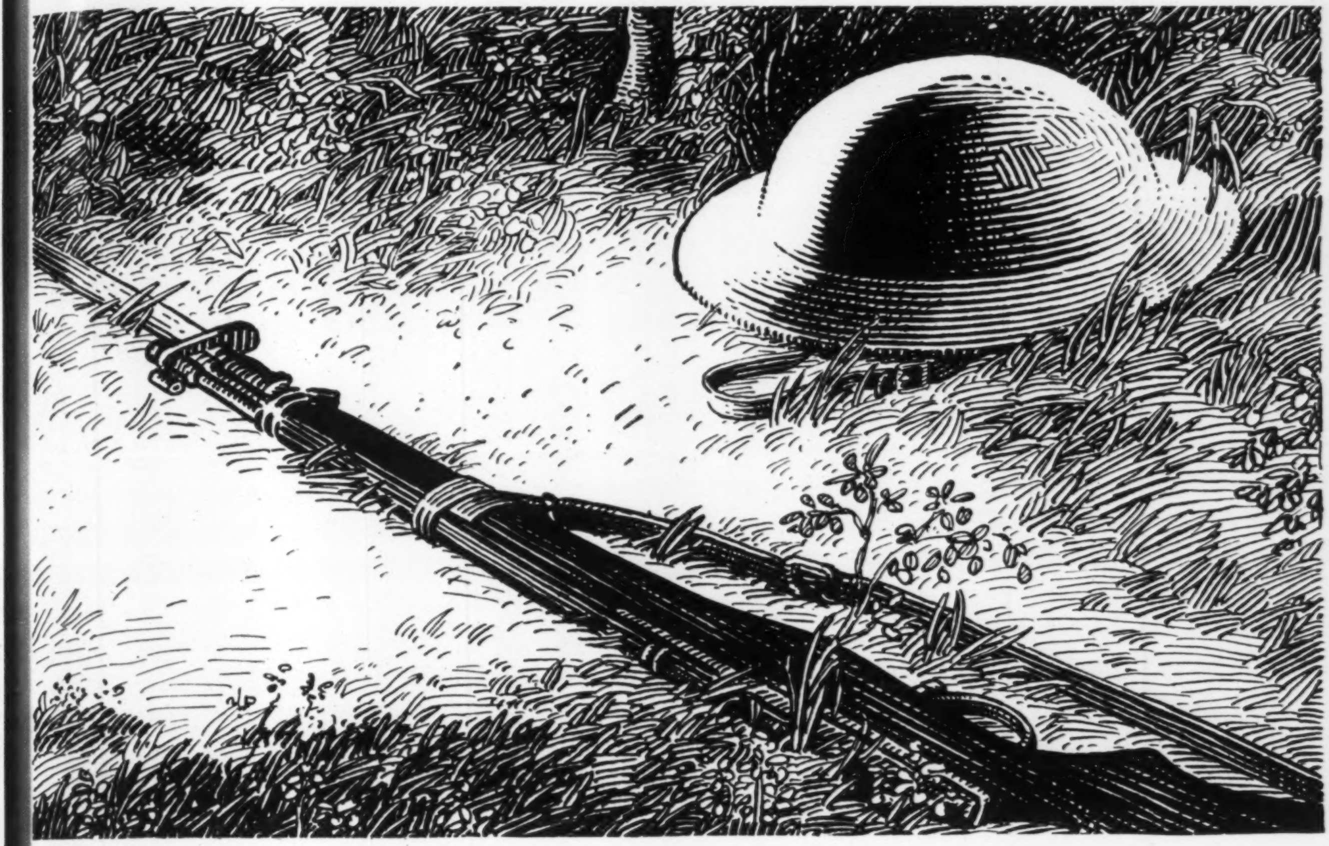
Circuit Breaker Plug



No. 2427—A new circuit breaker plug replaces the conventional receptacle plug and provides protection against overload for fractional horsepower motors, power tools, devices using heating elements, etc. The plug automatically disconnects the faulty piece of equipment from its electric supply.

The plug does not have to be renewed after the circuit has been broken. It is reset by raising and lowering a lever and there are no fuses required or servicing to be done.

The plug is actuated by heat, thus providing a time delay feature that prevents needless interruptions, says the manufacturer.—Hopax Industries, Inc., 1 N. La Salle St., Chicago, Ill.



. . . but COURAGE Still Lives

Courage is characteristic of the men in our armed forces. It takes courage, too, to "carry on" at home; to keep the faith; to serve without hope of glory; to make unstinted sacrifice of creature comforts, gladly, when the aims and ends of such denials are obscure.

Sure you're buying war bonds, but can't you dig a little deeper? Certainly you could use a new suit and shoes, but can't you "make do" a little longer with what you have? Of course you would like a new easy chair by the fire, but can't you make the old one do?

There are little adjustments in the home in the way we handle ourselves and our daily work, in our thinking and planning on how we can save waste in either time or materials—or both. These take courage, take sacrifice—and when your courage inspires sacrifices, you help meet your country's need, for "he also serves who saves."

> *Every shovelful of coal, every gallon of oil, saved, is released for the* SUCCESSFUL *prosecution of the war and eases the strain on over-burdened transportation.*

C. A. DUNHAM CO., 450 E. Ohio St., Chicago

REMEMBER—
HE ALSO SERVES
WHO SAVES

Dunham Makes Fuels Go Further

DUNHAM
HEATING SERVICE

FASTER—SIMPLIFIED
Dy-namic
BALANCING!
100 Dy-namically Balanced per Day
is this operator's performance, as reported by a manufacturer of radio communication generators. Operator had no previous experience and but three hours instruction.
REDUCE WEAR
ELIMINATE NOISE
CUT VIBRATION
IMPROVE EFFICIENCY

NEW AID TO WAR PRODUCTION
Solves Vibration and Manpower Problems

New—but already Bear Dy-namic balancing machines are in successful operation on many industrial fronts. Manufacturers of fans, blowers, motors, crankshafts and other rotating bodies, as well as maintenance departments charged with the repair of such bodies, report that these inexpensive machines represent a distinct advance in fast, simplified and accurate dy-namic balancing.

These machines provide for testing and a static and dy-namic balancing of rotating bodies in one continuous operation that meets all established requirements including government specifications for dy-namic balance. Solves Skilled Manpower problem, as almost any employee can be quickly instructed in their operation.

Bear machines are made in many sizes and types, ranging from bench models as illustrated above to large heavy-duty floor and pit models.

Engineering counsel is at your service. Write, wire or phone details of your problem or write for the free Data Booklet. Address Bear Mfg. Co., Dept. HP, Industrial Division, Rock Island, Illinois.

BEAR

STATIC AND DY-NAMIC BALANCING MACHINES

Fume Exhauster

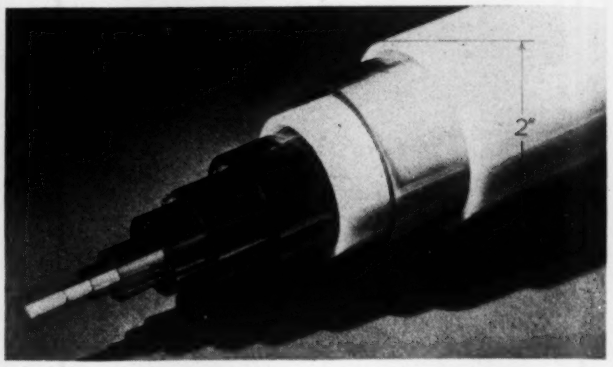
No. 2428—A new and improved fume exhauster was recently announced. According to the manufacturer, the fumes, gases, dust, filings, and grinding compounds which may be handled by it do not come in contact with the motor.

The centrifugal type blower wheel is made of ⅛ in. steel and the 3 hp ball bearing motor is tested to an overload capacity so as to meet rough usage.

This blower can be used in shipholds, welding rooms, tunnels, vaults, basements, etc.—Chelsea Fan & Blower Co., Inc., 1206 Grove St., Irvington, N. J.

Seamless Plastic Tubing

No. 2429—It was announced last month that "Tulox" seamless plastic tubing is now available in all diameters up to 2 in. OD and that within the next few weeks the range will be increased to 2½ in. OD to meet the requirements of war production.



Extruded from Tennessee Eastman cellulose acetate butyrate, this tubing is available from warehouse stocks throughout the country through Crane Co., 836 S. Michigan Ave., Chicago, Ill., and Julius Blum & Co., Inc., 532 W. 22nd St., New York, N. Y.

New Finish for Metal

No. 2430—A new coating for metal products has recently been developed and is known as "Armor-Vit." According to the manufacturer, it is essentially an alkali alumina silicate and it is applied in either one or two coats of 0.0005 to 0.0010 in. in thickness.

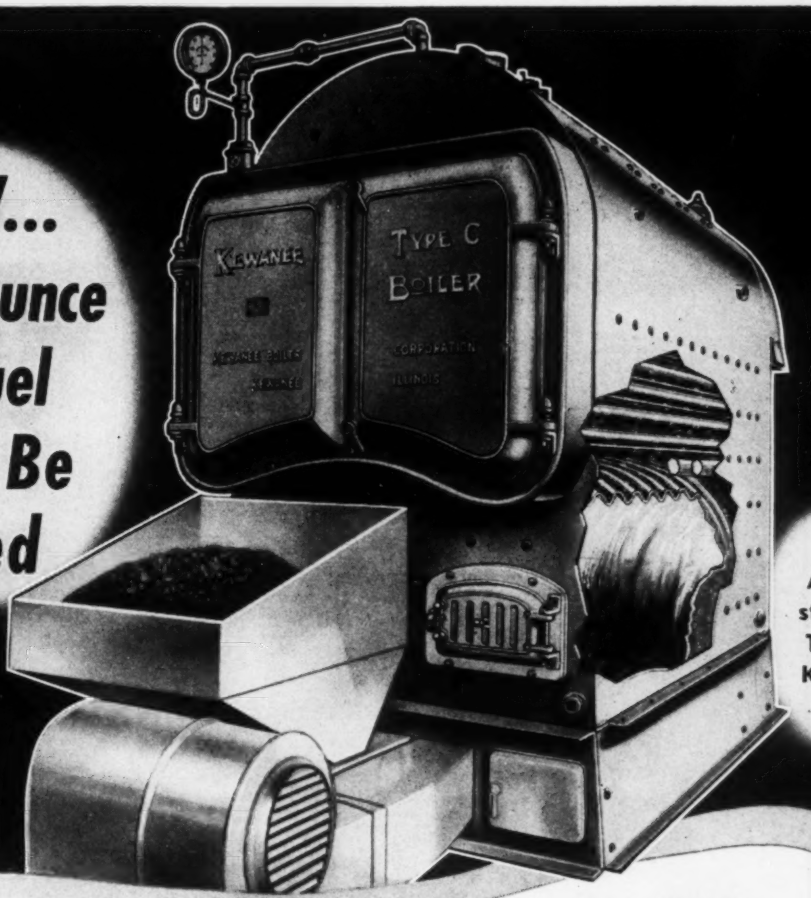
It is said to be an exceptional rust or corrosion resistant finish for metal products, such as the exhaust pipe illustrated. — Chicago Vitreous Enamel Product Co., Cicero, Ill.

Compressed Air Removes Fumes

No. 2431—A blast of compressed air of less than five minutes duration through a tall flue has solved the problem of driving off fumes from an electric furnace used to oil-harden small metal parts in one manufacturing plant, according to the Compressed Air Institute.

The air jet has eliminated the necessity of a blower. After the heat has started, the oil which has remained on the metal stampings begins to bake off and produce fumes. The blast of air, which has a pressure of approximately 60 psi, is turned on and carries off the fumes until normal draft from the heated furnace starts. The pipe leading to the flue has an elbow joint on the end which directs the air

NOW...
Every Ounce
of Fuel
Must Be
Saved



A typical
stoker fired
Type "C"
KEWANEE

KEWANEE
STEEL BOILERS

DO MORE WITH LESS FUEL . . . AND INSURE A LIFETIME OF DEPENDABILITY

• In the Kewanee Type "C" the Corrugated Crown Sheet provides extra effective heating surface and helps make higher *overall efficiencies* a regular occurrence. The massive ridges of the corrugations add rugged strength which insures extra years of service.

In the Kewanee line is a steel boiler for 'most every heating and power purpose.

Write us for factual information.

ARMY E NAVY

"E" Award for Kewanee's High Achievement in the Production of War Equipment

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Branches in 60 Cities—Eastern District Office: 40 West 40th Street, New York City
Division of AMERICAN Radiator and "Standard" Sanitary Corporation

Saves Critical Material

RUN YOUR UNDERGROUND STEAM AND HOT WATER LINES IN

BANNON ADSCO TILE CONDUIT

The metal that would be required if all underground steam and hot water lines installed this year were run in metal conduit, would build a surprising number of tanks and guns.

That is why ADSCO-Bannon Tile Conduit is America's No. 1 wartime conduit.

With the exception of a very small amount of metal used in pipe supports and rollers, ADSCO-Bannon Conduit is made of non-critical materials — Vitrified Clay Tile — fiberglas insulation.

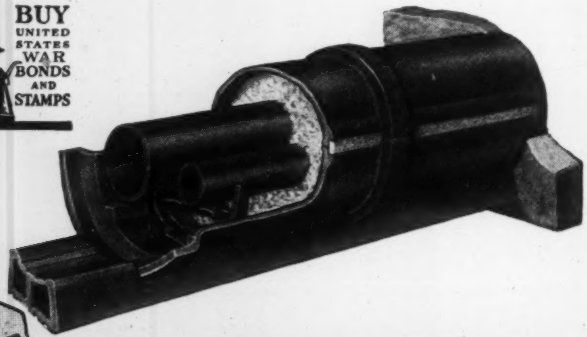
Also, in ADSCO-Bannon Tile Conduit, a specially designed tile base drain provides adequate drainage for the underground lines. This prevents flooding of the conduit, thereby maintaining its thermal efficiency. Easily installed with a minimum of labor —makes a permanent installation.

Submit details of proposed installation for prompt quotation or write for illustrated bulletin No. 35-67HP.

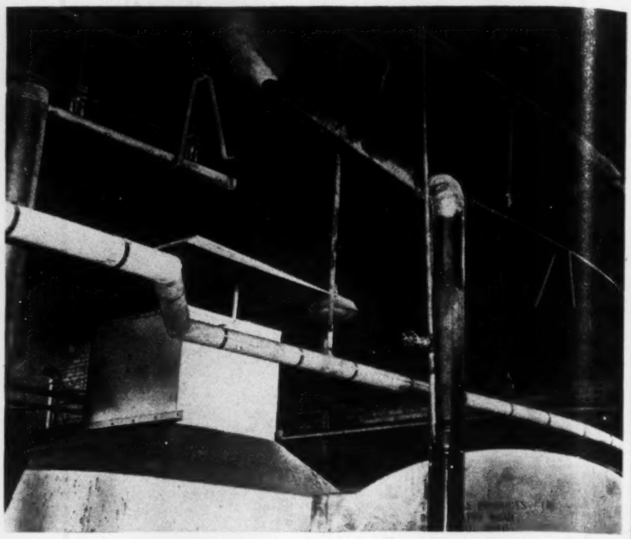
AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.

MAKING "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 60 YEARS

FOR VICTORY
BUY UNITED STATES WAR BONDS AND STAMPS



BASE DRAIN.... PREVENTS WATER SEEPAGE FROM FLOODING CONDUIT



upward. This starts the fumes moving upward, and as a steady flow is achieved, the air is turned off and the flow continues until the heat in the furnace is completed.

The outlet of the flue is situated at a cupola in the roof where the fumes are taken away by draft.

Evaporative Condensers and Oil Coolers

No. 2432—By redesign of an evaporative condenser line to use a minimum of critical materials and to increase the adaptability of the units to essential wartime industrial applications, a new line of evaporative coolers and condensers has been created.

Consisting of various combinations of two basic assemblies—the spray cooler assembly and the fan assembly—the new line is a radical departure from previous design. For evaporative condenser models, an externally mounted refrigerant receiver is supplied.

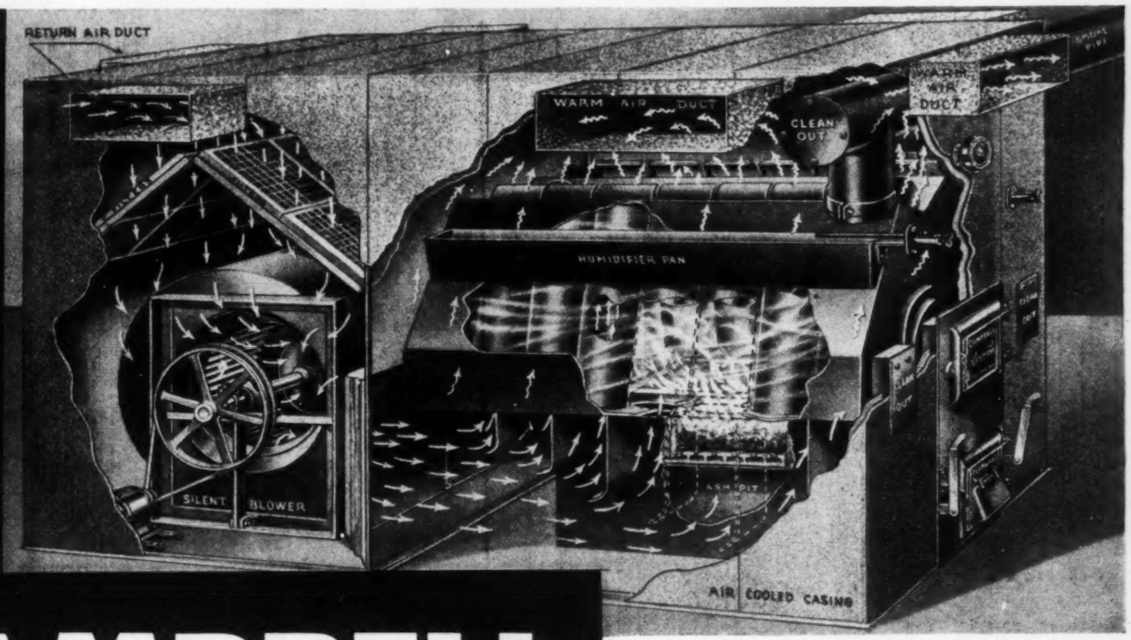
Outstanding feature of the line is the design of the nested heat transfer coil assembly composed of individual light weight coil sections, which are easily removed and disassembled for cleaning or refinishing. The manufacturer says that two men with ordinary service tools, a rope, a couple of short four by fours, and a brush, can clean a single spray cooler section and have it back on the line in two hours.

Each standard unit consists of one or more basic spray cooler sections plus one or more fan sections and small subassemblies. These basic units are compact and light in weight, easy to rig in place, even in locations where space is restricted. They are separately demountable and may be serviced or replaced individually.

The units are of steel construction, electric arc welded throughout. The sandblasted steel casing and frame is finished with three baked coats of phenolic resin base enamel, plus one air dry coat of blue grey enamel. The heat transfer assembly is standard weight bare pipe, bonderized and finished with three coats of phenolic resin base enamel.

The basic ratings of the evaporative cooler units are for water, from 250,000 to 3,000,000 Btu per hr, gross heat removal effect based on 78 F entering air wet bulb temperature, 130 F average water temperature, 10 F temperature rise; for oil, 60,000 to 720,000 Btu per hr, gross heat removal effect based on Houghten's No. 2 quenching oil, 78 F entering air wet bulb temperature, 110 F average oil temperature, 5 F temperature rise.

The basic ratings of the evaporative condenser line range from 67,750 to 813,000 Btu per hr. The net refrigeration effect is based on 78 F entering air wet bulb temperature, 105 F condensing unit temperature, and 40 F evaporating refrigerant temperature.—General Electric Co., 5 Lawrence St., Bloomfield, N. J.


RETURN AIR DUCT
WARM AIR DUCT
CLEAN OUT
WARM AIR DUCT
HUMIDIFIER PAN
SILENT BLOWER
ASH PIT
AIR COOLED CASING

CAMPBELL
8000 SERIES
HEATERS
for large buildings, industrial plants, etc.

Campbell 8000 Series "Winter-Chaser" Air Conditioner—a complete, self-contained heating unit.

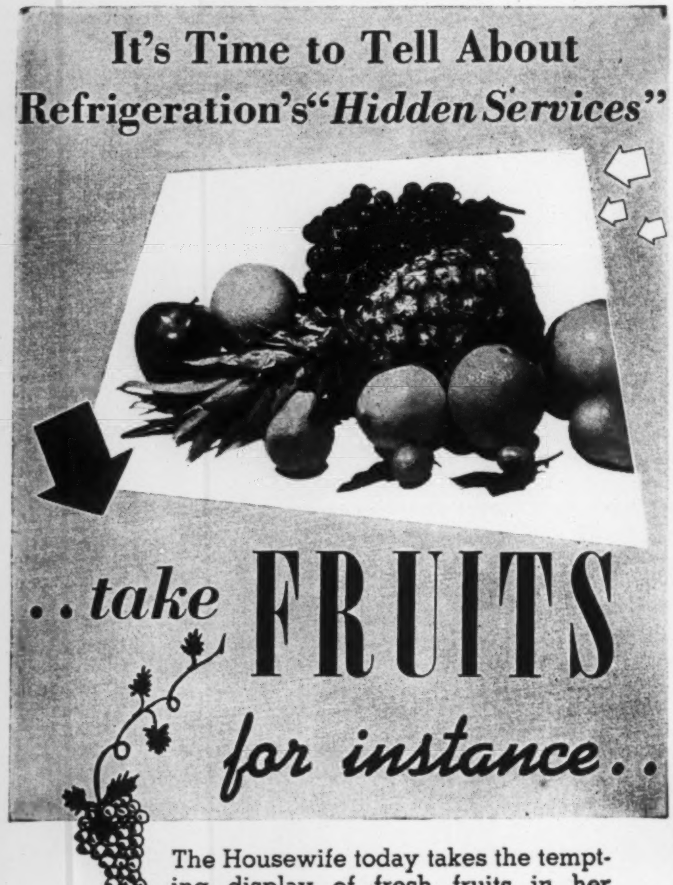
- **EASILY INSTALLED**
- **COMPACT—EFFICIENT**
- **ECONOMICAL TO OPERATE**

Campbell 8000 Series Heaters are available for all fuels in capacities ranging from 500,000 to 2,160,000 B.t.u. per hour. Let us submit prices and complete specifications on a Campbell Heater to meet your special requirements. No obligation.

Campbell Heating Company
DES MOINES, IOWA

63 years of successful heating experience

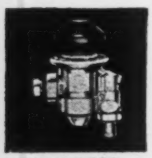
Prompt Delivery on Rated Orders
Write for full details and attractive prices.

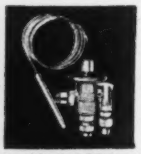


The Housewife today takes the tempting display of fresh fruits in her favorite market quite for granted. But behind every shipment of fruit at that market is an endless chain of Refrigeration that staggers the imagination.

Hundreds of great refrigerated warehouses, receiving stations close to the orchards, carefully air conditioned storage plants at distribution centers, thousands of smaller plants at wholesale and retail markets—all are today working round the clock to assure plenty of fresh fruit in the American home. It's a responsibility more important now than ever before in compensating for rationed canned fruits.

A-P DEPENDABLE REFRIGERANT VALVES help maintain the burden of this hard-working mechanical refrigeration in every type of application, large or small, from orchard to home refrigerator.


Model 204


Model 205

Model 215

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN
Export Dept. 100 Varick St., New York City

AP DEPENDABLE Refrigerant Valves

All Purpose Building Board

No. 2433—Developed to help meet the need for materials to take the place of sheet metal, a specially fabricated asbestos cement, all purpose, building board has recently been introduced and is known as "Stonewall." According to the manufacturer, it is fireproof, rotproof, verminproof, and of course rustproof, and needs no paint.

This board is made in standard sizes of 4 x 8 ft and is available in 3/16, ¼, and ⅜ in. thicknesses. It may be used for construction of ducts, as a "protection and finish" for boilers and furnaces, as well as for partitions and other miscellaneous uses.—Ruberoid Co., 500 Fifth Ave., New York, N. Y.

Useful Information

New WPB Regulations Affecting Heating, Piping, and Air Conditioning

[*Issued February* 18 *to March* 23, *inclusive. Selected from listing compiled especially for Victory, official bulletin of the Office of War Information, by field contact branch of the War Production Board.*]

Order L-42, schedule II amended. Grey cast iron, malleable iron, brass and bronze pipe fittings. Adds table 2A, grey cast iron pipe fittings, and table 4A, malleable iron pipe fittings, reducing, etc.

Order L-123, amended. General industrial equipment. Partially eliminates necessity for certification on maintenance, repair parts; removes items from list A, and adds fractional horsepower motors.

Order L-154, schedule III, revocation. Feedwater heaters. Revokes schedule III.

Order L-217, schedule VII. Pumps. Limits production and assembly by sizes and types; applies to painting and accessories.

Order L-217, schedule 7, amended. Pumps. Corrects technical error in order on 8 in.—125,000 gph pump.

Order L-252, amended. Valves and valve parts. Corrects three typographical errors in printed order.

Order L-268. Oxyacetylene apparatus. Restricts delivery and acceptance to AA-5 or better rated orders, subject to certain conditions; restricts manufacture, sales, repairs, inventories; permits allocation of production.

Order L-272. Industrial type instruments, control valves, and regulators; simplification. Permits establishment of simplification schedules regarding sizes, forms, specifications, composition, or other qualifications.

Order L-272, schedule I. Control valves. Establishes specifications of size, forms, and composition.

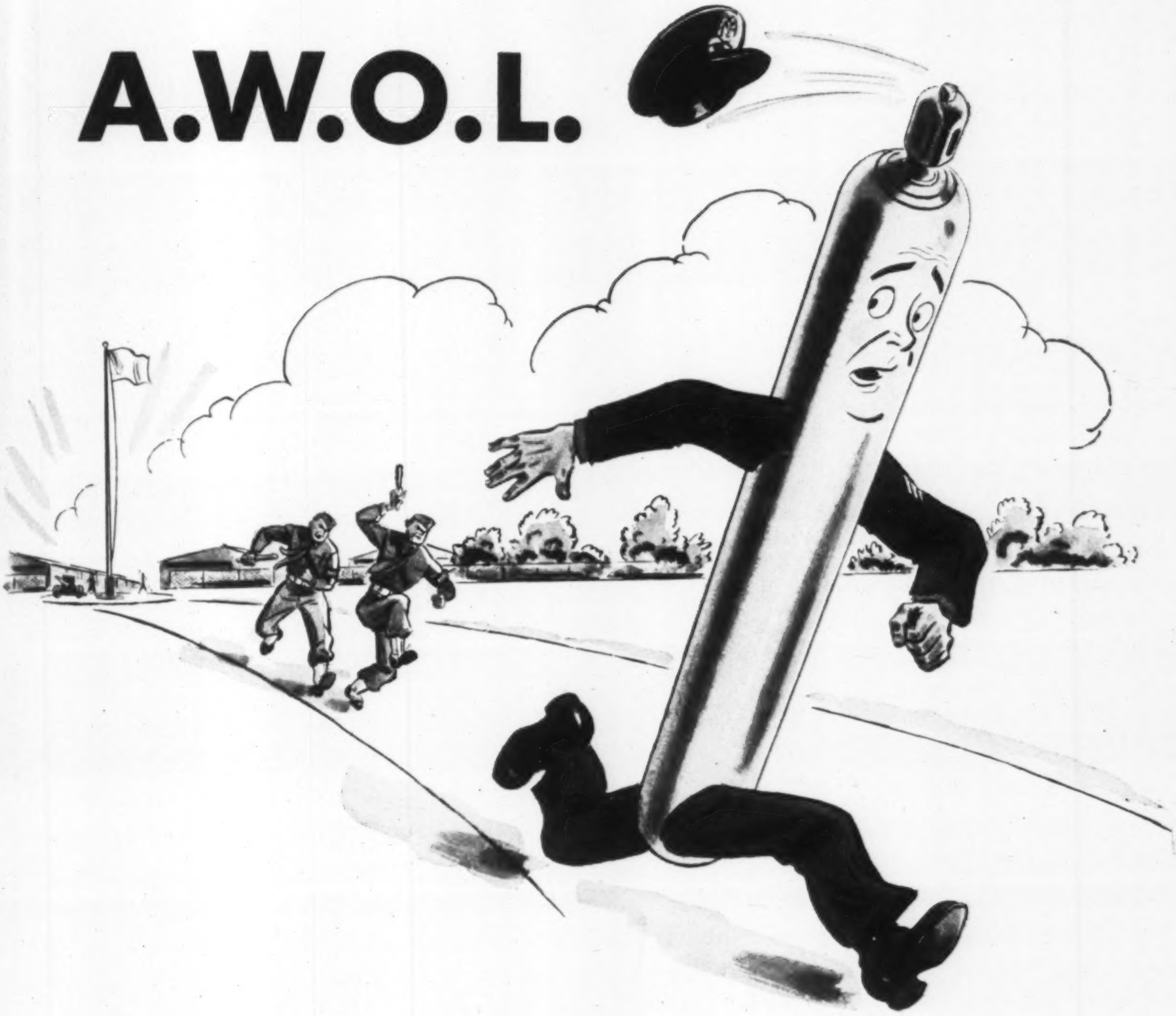
Order L-272, schedule II. Liquid level controllers. Specifies size of equalizing connections.

Order L-272, schedule III. Pyrometers and resistance thermometers. Establishes features to be eliminated.

Order M-9-b, amended. Copper. Prohibits disposition of material received as scrap except in manner specified.

Order M-9-c, amended. Copper. Amends restrictions on copper products or copper base alloy products not controlled

A.W.O.L.



SEND HIM BACK immediately to his post (Carney's Point, N. J.). You'll recognize him instantly—he's the empty "Freon" cylinder in your shop.

He's needed for war duty—to carry "Freon" to war production plants, to military bases, and to you in your job of servicing vital civilian needs.

When you return him, be sure to include that brass cap that belongs on the valve. We can't get new caps for love or money—and a cylinder without one is almost as bad as no cylinder at all.

RETURN CYLINDERS THE INSTANT THEY ARE EMPTY

KINETIC

KINETIC CHEMICALS, INC., *MAKERS OF "FREON"* SAFE REFRIGERANTS*

**"Freon" is Kinetic's registered trade mark for its fluorine refrigerants*

by order; amends combined list, list A-2, military exemption list.

Order M-144, revocation. Fuel oil. Revokes the order; superseded by M-201.

Order U-1, revokes P-46. Electric, gas, water, steam utilities—materials. Assigns AA-1 to deliveries for maintenance, repair, operating supplies; assigns lowest rating of rated project or rated equipment for construction of transmission, switching, and distribution facilities; establishes procedure for obtaining controlled materials; restricts delivery, inventory, withdrawals, additions to plant, sales from inventory.

Order U-1-a, revokes P-46-a. Electric, gas, water, steam utilities—materials. Permits service connections to facilities of Army, Navy, Maritime Commission, if not over 250 ft in length, and not to exceed $1500 for underground construction and $500 in other cases.

Order U-1-d. Electric, gas, water, and steam utilities—materials. Permits electric, gas, and water connections to premises being constructed or remodeled under L-41, subject to certain provisions.

Ventilation of Magnesium Foundries

A reader of HPAC recently asked for references on the subject of ventilation of magnesium foundries and the problems encountered therein. Through the courtesy of Leslie Silverman, Associate in Industrial Hygiene, School of Public Health, Harvard University, the following list (not necessarily complete) of articles and papers on the health hazards of magnesium is presented.

Metal fume fever III: The effects of inhaling magnesium oxide fume, Philip Drinker, R. M. Thomson, and Jane L. Finn., Journal of Industrial Hygiene, May, 1927.

The prevention and treatment of affections occurring in the magnesium industry, Noel Hypher, The Practitioner (London) No. 872, vol cx/vi No. 2, February, 1941.

Health aspect of the magnesium industry, H. H. Gay, Iron Age, Vol. 150, No. 23, pp. 60-63 (1942).

Chemical gas gangrene from metallic magnesium, C. P. McCord et al, Industrial Medicine, February, 1942.

The physiologic action of metallic magnesium, S. F. Meek et al, Journal of Industrial Hygiene and Toxicology, June, 1942.

Magnesiogenous pneumogranuloma, R. Schulz and C. W. Walter, Journal of Industrial Hygiene and Toxicology, June, 1942.

Industrial health hazards in magnesium foundries. Illinois Labor Bulletin, Vol. 3, pp. 8-9, September, 1942.

Action of finely divided magnesium upon the lungs. L. U. Gardner and A. B. Delahant, American Journal of Public Health, February, 1943. See also papers presented at annual meeting of Industrial Hygiene Foundation in November, 1942.

Atmospheric contamination from the casting of magnesium. C. R. Williams, Journal of Industrial Hygiene and Toxicology, November, 1942.

Additional references on magnesium, compiled by Mrs. Ellen Bellingham, of the U. S. Public Health Service, include:

Health hazards in handling magnesium. Waldemar Schweisheimer. Iron Age, 150: 56-57, July 16, 1942.

Metals that burn. W. H. Borum. Natl. Safety News, 43: 25, 26, 82, November, 1941.

Toxicity of magnesium. Queries and minor notes, J. Am. Med. Assoc., 118: 337, January 24, 1942.

Prevention and treatment of affections occurring in magnesium industry. N. Hypher. Practitioner, 146: 92, February, 1940. Abst. War. Med., 1: 924, November, 1941, and in Ind. Hyg. Digest 5, 15, par. 752, September, 1941.

The toxic properties of selected less familiar metals. C. P. McCord and J. J. Prendergast. Medical Clinics of No. America, July, 1942.

Health hazards in steel mills. J. W. Fehnel. Indust. Med., 11: 358-60, July, 1942.

The physiologic action of metallic magnesium. S. F. Meek, J. J. Prendergast, G. C. Harrold, and C. P. McCord. J. Ind. Hyg. and Toxicol., 24: 142-47, June, 1942.

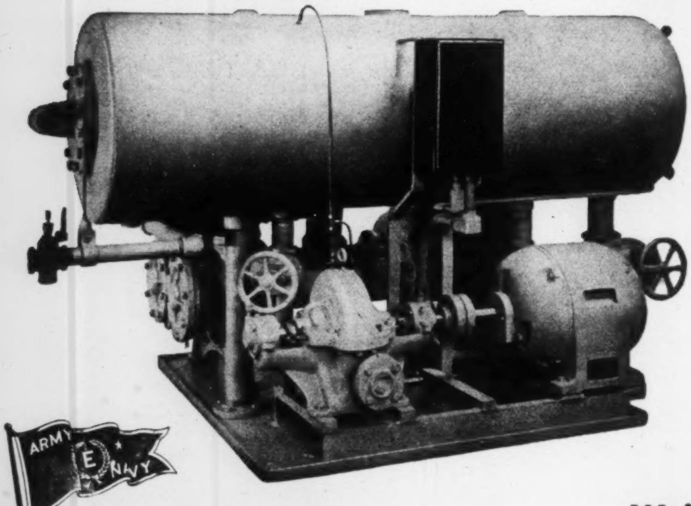
The casting of magnesium. C. R. Williams. Presented at Amer. Ind. Hyg. Assoc. convention, Cincinnati, O., April, 1942. Abst. Ind. Hyg. Digest, 6: 9, par. 363, April, 1942. (Published Journ. Ind. Hyg. and Toxicol., 24: 277, November, 1942.)

Chemical gas gangrene from metallic magnesium. C. P. McCord, J. J. Prendergast, S. F. Meek, and G. C. Harrold. Indust. Med., 11: 71-76, February, 1942.

Peculiar forms of disease observed in workers handling aluminum alloys with high percentage of magnesium. H. Zangger. Arch. fur Gewerbepathologie und Gewerbehygiene, 10: 1-3, 1940.

Effect of magnesium dust on organism of workers. A Pleschtizer. Arch. fur Gewerbepathologie und Gewerbehygiene, 7: 8-22, 1936.

Action of lead and magnesium on porphyrinuria in man. F. Capelli. Medicine del Lavoro, 27: 97-105, April, 1936.



CONDENSATE RETURN UNITS

FOR TOUGHEST SERVICE

Proper handling of condensate under severe operating conditions requires dependable equipment fabricated by a competent manufacturer.

Four complete series of Eagan Condensate Return Units, developed over twenty years to meet every operating condition, space requirement, and specification, assures this proper handling to the engineer, contractor, and owner.

Illustrated is the new Eagan Electro-Steam Unit for installation where costly shut-down due to electric power failure must be precluded.

ARMY E NAVY

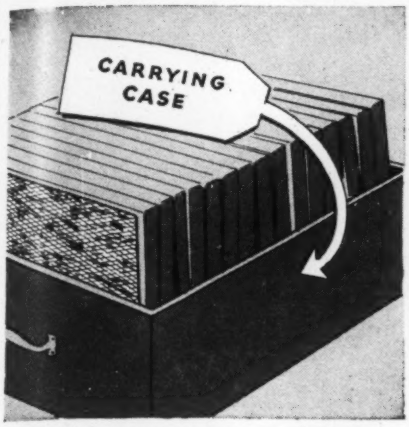
"E" Award for Walter H. Eagan Company's high achievement in the production of Condensate Return Units

PUMPS

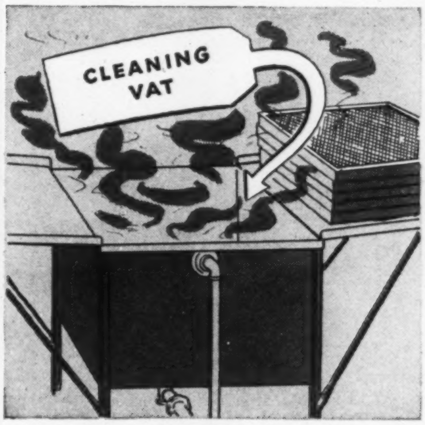
Write for General Catalog No. 2
Consult us on your requirements

WALTER H. EAGAN CO.
2336-38 FAIRMOUNT AVENUE, PHILADELPHIA, PA.

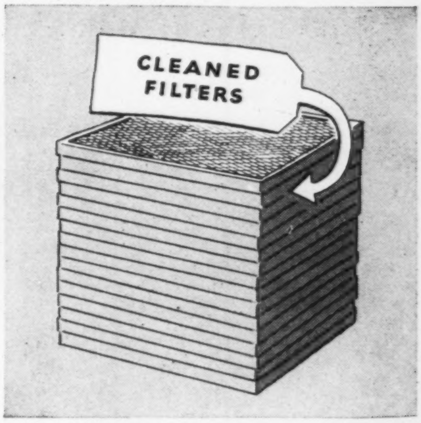
THE OLD WAY LOOKS PRETTY QUAINT TODAY



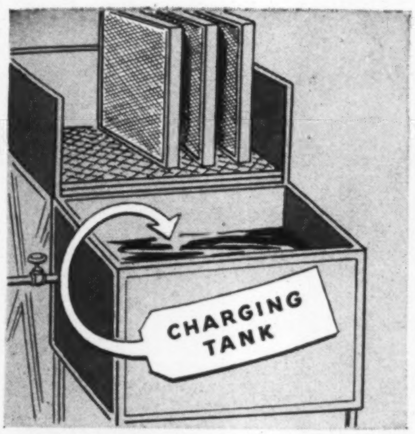
1 CARRYING CASE. It kept oil-adhesive on dirty filters from dripping on the floor as the filters were carried to cleaning room.



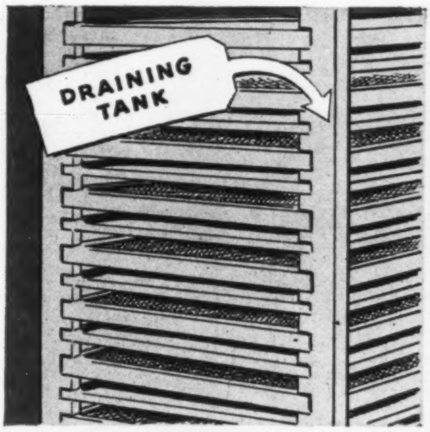
2 CLEANING VAT. This was filled with a detergent. The filters were dipped in the solution, moved up and down to remove dust and dirt particles.



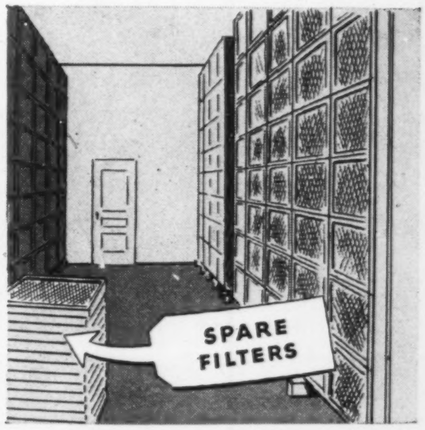
3 CLEANED FILTERS. After the filters came out of the vat, they were clean. But look at the jobs that followed!



4 CHARGING TANK. First, they had to be dipped in a tank and charged with a clean adhesive . . . more work followed.

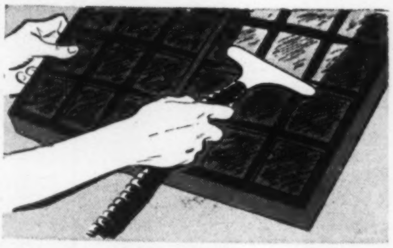


5 DRAINING RACK. Then they had to be sure that excessive adhesive was drained off to prevent its being carried into the air stream. It took several hours for the filters to drain.

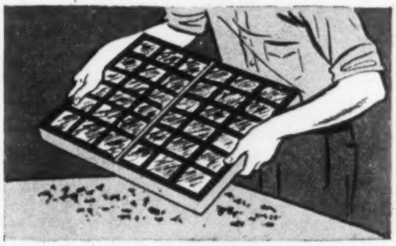


6 TIME AND TROUBLE. All this tied up workmen from other jobs; it was necessary to shut down the equipment or keep a number of "spares" on hand.

Compare modern Dust-Stop* way with old methods



Dust-Stops are easily and quickly removed. Intake face of filters are vacuumed or gently rapped out to remove surface dirt accumulations. There's nothing more to do ...no washing, charging, draining, storing.



After a few such cleanings, the face filters are removed and replaced with new filters.

In many installations it is as economical to replace Dust-Stops at regular intervals without intermediate cleaning.

Think of the man hours of labor that are saved! Dust-Stops cost only 1¢ per CFM to install; less than 1/10th of 1¢ per CFM to replace. Do you wonder that Dust-Stops are the largest-selling filters today? Do you wonder that they are used in nearly every type of war industry? Write for complete information.

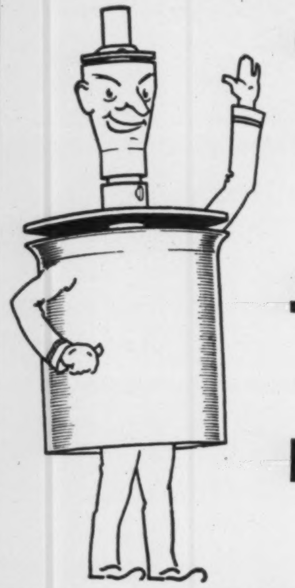
Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.

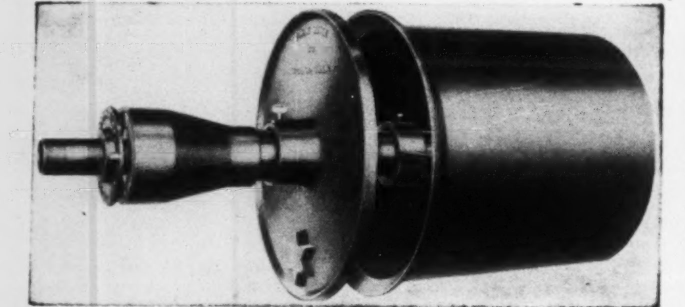
ARMY E NAVY

FIBERGLAS* DUSTOP* AIR FILTERS

*T. M. Reg. U.S. Pat. Off.

"INCREASE furnace CAPACITY Right Now with JOHN ZINK Horizontal Bi-Mix Burners"





We feel sure this No. 14 HORIZONTAL BI-MIX BURNER will fire a furnace to a higher rating than any other type of burner made and still maintain even heat distribution. It will burn gases of varying heat values without adjustment. It is not damaged by slugs of oil, gasoline or water, that sometimes blow through them from the fuel line.

John Zink manufactures over 50 TYPES of burners including OIL BURNERS.

Write for Details Now!

John Zink Co.

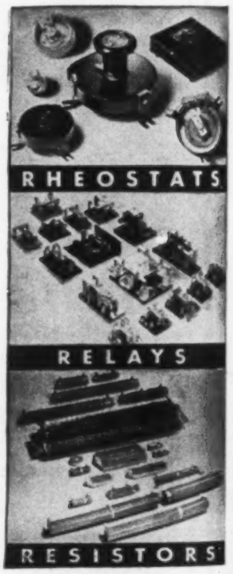
TULSA, OKLAHOMA

New York • Los Angeles • Detroit • San Francisco

RESISTORS ON 24-HOUR WATCH

ARMY E NAVY

Electrical equipment aboard ship has no off-duty time. Radio, inter-communication, air conditioning, ventilation, refrigeration, deck machinery, gun operation and innumerable other vital services employ resistors in their control circuits. These resistors must be dependable to function at all times. Ward Leonard Vitrohm Resistors have measured up to their responsibilities. Their ability to withstand moisture, temperature change, shock and vibration makes them particularly well fitted for sea duty. Resistors with the same ruggedness as those used by the Navy and Merchant Marine are available to all industry engaged in victory production. Send for data sheets.



WARD LEONARD

Electric control WL *devices since 1892.*

WARD LEONARD ELECTRIC COMPANY
31 SOUTH STREET, MT. VERNON, NEW YORK

Magnesium's role in muscular fatigue. C. Fahrig and L. Wackin. Beit. x. Path. Anat. u.z. Allg. Path., 83: 115-25, 1929.

Magnesium poisoning: A study of 10 cases. J. Amer. Med. Assn., 55: 2037-42, 1910.

Magnesium alloys (industrial data sheet D-Me. 15). National Safety News, 45:56, 58, June, 1942.

Dehydration of Fruits And Vegetables

Preservation of Fruits and Vegetables by Commercial Dehydration, by E. M. Chace, W. A. Noel, and V. A. Pease, all of the U. S. Department of Agriculture, was issued September, 1941, and slightly revised in February, 1942.

The importance of dried foods in the efficient prosecution of our expanding war effort lends more and more importance to this 46 p. booklet, which summarizes the accumulated knowledge up to 1942 on the subject of the commercial drying of fruits and vegetables. It supersedes previous departmental bulletins on fruit and vegetable drying, the first of which appeared during World War I.

For those desiring a background of the processes involved in the dehydration art, this circular is an excellent introductory guide. The reader is told first about the reasons for and the advantages of the drying of fruits and vegetables. Next, a comparison is made between the magnitude and economic importance of fruit and vegetable drying during the past two decades. Four pages are then devoted to the preparation and pretreatment of fruits and vegetables prior to drying. The preparatory processes described are washing, grading for size, peeling, trimming, checking, subdividing, pitting and seeding, traying, and conveying the trayed material. The pretreatment processes are the usual ones of sulfuring as applied to light colored fruits, and blanching as applied to vegetables.

The drying process is described in the succeeding 20 pages. Included in this section are a brief discussion of the types of dryers, examples of the usual psychrometric calculations as applied to dryer design, a discussion of the effects of the drying conditions on product quality, and the calculations involved in what has been termed the design of a tunnel dryer. It is well to point out that only a brief and sketchy outline of the technical aspects of the drying process is presented, and for more detailed information on drying and design calculations the reader must seek elsewhere. Unfortunately, the authors chose to depart from the usual presentation of the properties of air-water vapor mixtures in a single chart with the usual coordinates of humidity vs. temperature, and they presented instead a series of charts dissected—so to speak—from the customary humidity chart. This multiplicity of charts makes the presentation of the usual psychrometric calculations cumbersome. The example calculations for a tunnel dryer are the usual ones of heat and material balances with little importance given to the drying rate. This latter factor should receive more attention, and its importance in dehydrator design should be emphasized.

An excellent summary of the preparatory processes, and drying conditions, such as time and temperature, is presented for a number of fruits and vegetables in tabular form. In conclusion, valuable detailed directions for preparing and drying the principal fruits and vegetables are given.

Supplementing the body of the circular is an extensive list of patents on food drying as well as five pages of additional literature references. Anyone entering the field of fruit and vegetable drying would do well to begin by reading this publication.

Identified as circular No. 619, copies may be had from the Superintendent of Documents, Washington, D. C., for 10c.—W. R. MARSHALL, JR.

Tables of Hygrometric Data

Tables of Hygrometric Data for Air, published by the Institution of Heating & Ventilating Engineers, 21 Tothill St., London, S.W. 1., England, is a little brochure giving fundamental hygrometric data for both saturated and unsaturated air. Its price is 2s. 9d.

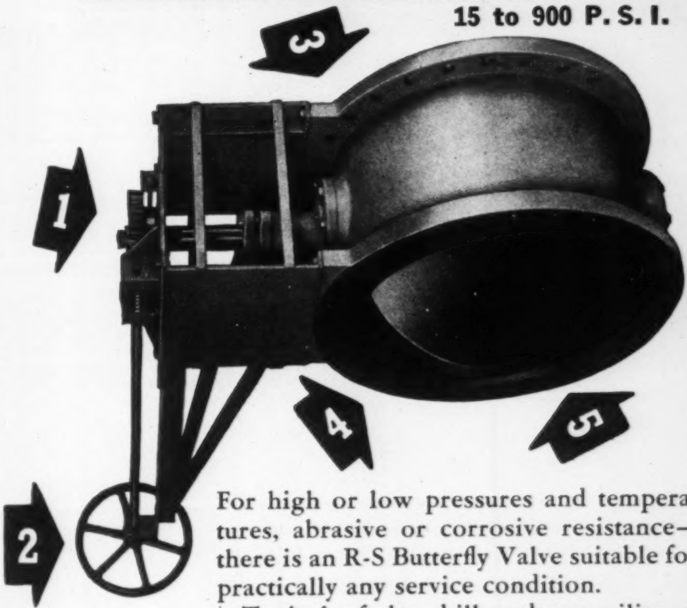
Current American tables cover only saturated air, and

Simplify

R-S
QUALITY PRODUCTS
SINCE 1908

Control and Shut-Off for Inaccessible Locations

15 to 900 P. S. I.



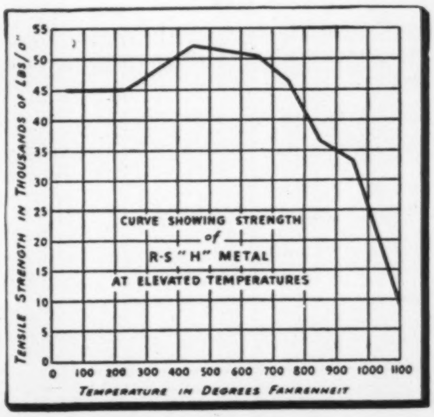
For high or low pressures and temperatures, abrasive or corrosive resistance—there is an R-S Butterfly Valve suitable for practically any service condition.

Typical of the skill and versatility of R-S Engineers is this standard 125 pound valve with extension shaft and hand wheel for inaccessible locations. Consider these outstanding features.

1. Oversize gear and worm.
2. Six hand wheel revolutions complete full vane movement.
3. Husky vane shaft mounted in grease-sealed stuffing box.
4. Body and vane can be cast of special R-S "A" or "Abrasive" metal for extra-long wear.
5. Beveled vane is precision machined—seats wedge-tight against valve body. Constructed to any A.S.M.E. dimensional standard. Sizes to 72-inches.

VALVE DIVISION
R-S PRODUCTS CORPORATION
132 Berkley Street Philadelphia, Penna.

A SUBSTITUTE FOR STEEL!



R-S Engineers have developed special metals for resistance against heat, abrasion and corrosion. For example, R-S "H" Metal is an alloy semi-steel that machines like cast iron. Tensile up to 50,000 p.s.i. Withstands high pressures and penetration of steam and gases up to 1000°F. Stress relieved up to 1400°F.

Request detailed information and Catalog No. 10-B.

R-S Streamlined BUTTERFLY VALVES

25 Years' Service to the industry

ACME PRODUCTS

May our engineers help you?

REFRIGERATION AND AIR CONDITIONING EQUIPMENT

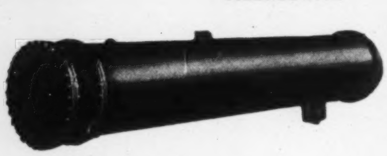
EVAPORATIVE CONDENSERS
All prime surface cooling coils. Copper or steel.
AMMONIA CONDENSERS
Shell and Tube—Horizontal or Vertical

FREON SHELL and TUBE CONDENSERS
Capacities 2½ to 450 Tons—Steel or Copper Tubes

CLEANABLE

Many water pass combinations

Larger sizes cleanable without breaking water connection



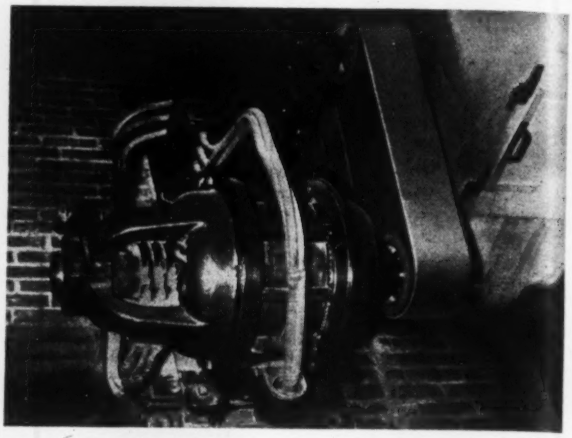
WRITE FOR CATALOG No. 23

DIRECT EXPANSION WATER CHILLERS
Indirect Air Conditioning and Processing Water
FLOODED WATER CHILLERS
Drinking and Ingredient Water
HI-PEAK WATER COOLERS
Storage type. Direct Expansion
CASCADE WATER COOLERS
Aerator Type, Bottling Plants
BRINE COOLERS
Steel Tubing or Pipe
FINNED COILS
Air Conditioning—Low Temp.
PIPE COILS
Steel—½" to 2"
HEAT INTERCHANGERS
Refrigerant Suction Line—Liquid to Gas
OIL SEPARATORS
Separators—Not Traps
LIQUID RECEIVERS
Refrigerant
FORCED CONNECTION UNITS
Cold Dispensers
ACCUMULATORS
Refrigerant
SURGE DRUMS
Refrigerant
SHELL and TUBE HEAT EXCHANGERS
Liquid to Liquid—Gas to Gas, etc.

WRITE FOR CATALOG ON ANY OF THESE PRODUCTS

ACME INDUSTRIES
JACKSON • MICHIGAN

YEARS OF SERVICE



This is the outstanding characteristic of the Tannate-Rockwood drive . . . For, with little attention other than an occasional application of Rhoads Belt Preserver, the Tannate leather belt smoothly transmits maximum power throughout long working shifts—with minimum stretch and slippage, and despite adverse conditions of heat, humidity, or exposure to machine oils or weak acids.

If the load varies, the weight of the motor on the pivoted Rockwood base automatically adjusts the belt tension. Consequently, there's no time out for belt take-ups; the Tannate belt maintains full pulley contact, pulls steadily.

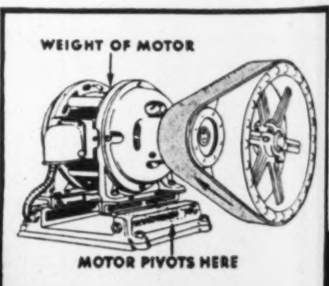
Yes, this is the drive to use. For reliability and maximum output investigate Tannate-Rockwood performance.

J. E. RHOADS & SONS

Established 1702

35 N. SIXTH STREET
PHILADELPHIA, PA.

NEW YORK • CHICAGO
ATLANTA • CLEVELAND



RHOADS
Tannate-Rockwood
PRODUCTION DRIVE

for properties of unsaturated air, American users generally make ingenious use of the tables for saturated air or they refer to a psychrometric chart. This book, on the other hand, lists the properties of unsaturated air rather completely. A page is devoted to each dry bulb temperature from 30 to 106 F by 1 deg intervals. On each page the independent variable is relative humidity from 0 to 100 per cent in intervals of 4 per cent. For each intermediate relative humidity between 0 and 100 per cent, the table lists the vapor pressure of air, the dew point, moisture content, total heat, volume, and wet bulb temperature.

A feature which will be unfamiliar to American readers is that two wet bulb temperatures are given for each combination of dry bulb temperature and relative humidity. In American practice, when extremely accurate data are desired, the reading of the particular wet bulb instrument being used is corrected to the temperature of adiabatic saturation before using charts or tables to determine the properties of the air. For most practical work, the correction is negligible for a rapidly rotating sling instrument where the difference between the temperature of the surrounding walls and the wet bulb temperature is not too large. The two columns of different wet bulb temperatures are headed "screen" and "sling", respectively. The wet bulb temperatures headed "sling" are presumably those obtained with a sling psychrometer such as we commonly use. The wet bulb temperatures in the column headed "screen" are presumably those obtained with some variant of the common sling instrument. Unfortunately, as the explanation in the foreword is meager, this reviewer was unable to determine just what was meant by the "screen" wet bulb temperature. The wet bulb temperatures in the "screen" column are slightly higher than those in the "sling" column.

The foreword to the tables states that they may be used without sensible error for altitudes up to 3000 ft. Incidentally, all the tables are based on a pressure of 1000 millibars, equivalent to 14.5 psi or 29.53 in. of mercury.

Engineering Standards for Heat Loss Calculations

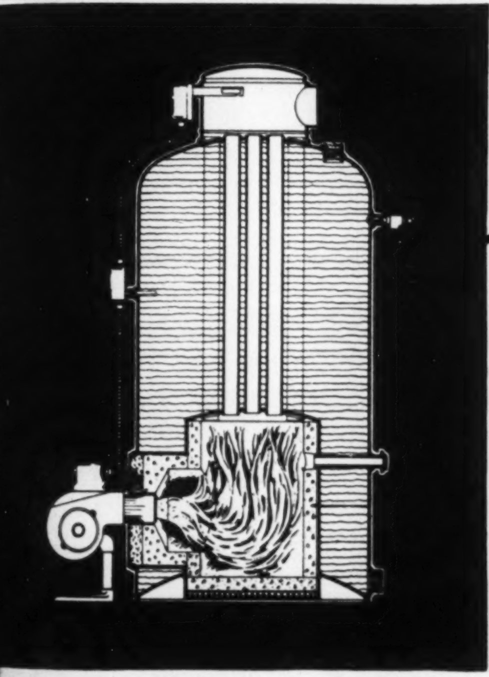
The Heating, Piping and Air Conditioning Contractors National Association, 1250 Sixth Ave., New York, N. Y., has issued a fourth edition of Part 1 of its Engineering Standards on Heat Loss Calculations for its members. This 28 p. booklet gives complete data for computing heat losses from buildings, the coefficients of transmission having been changed slightly from those in the third edition in order to bring them into agreement with the values given in the Guide of the American Society of Heating and Ventilating Engineers.

Of special interest due to the importance of heat conservation are two tables from which heat transmission coefficients for insulated and uninsulated walls can be obtained readily without computation. The standard radiation estimating table has been revised so that amounts of radiation can be read directly from wall or glass area or lineal feet of crack.

Every effort has been taken to make the tables easily legible. Large type and ample spacing are used to minimize eye strain.

Air Conditioned Office Buildings and Apartments After the War

In a talk on the office building industry in the postwar period at the recent Southwest Conference of Building Owners and Managers, reported in Buildings and Building Management, Frank M. Whiston of the Pittsfield building, Chicago, pointed out that the second, third, and fourth floors of most properties present the greatest enigma and require ingenious thought to produce revenue. Air conditioning these floors makes them desirable and in many instances more easily rented than space higher in the building. This is irrefutable because, says Mr. Whiston, "we have done so in our properties in Chicago."



Johnson
gives you more Hot Water
from each gallon of Fuel Oil!

Look at these *Efficiency Rating* figures for the Aqulux-225 . . . a typical model of Johnson's heavy duty water heaters:

Stack temp. at full capacity....................400° F.
CO_2............12% Stack loss............14%
Efficiency Rating............80%

Performance like that pays dividends in lower fuel consumption and shorter recovery time. And don't forget . . . this performance is achieved by Aqualux Heaters built to wartime specifications . . . without insulation, galvanizing or jackets, and with a minimum of copper and aluminum.

The Army, Navy and essential industries are getting practically all that are now available. But a day of Victory is coming . . . soon, we hope . . . when anyone may have them. When that day comes, you will find we are still carrying on the 40-year-old Johnson tradition of fine engineering and fine workmanship in the building of Oil Burning Equipment. S. T. Johnson Co., 940 Arlington Ave., Oakland, Calif. and 401 No. Broad St., Philadelphia, Pa.

This is our Vertical-self-storage type "Aqulux-225." Other Heavy-Duty Aqulux models include Horizontal, Vertical-Horizontal, Vertical-nominal-storage types.

AQULUX
Heavy Duty
WATER HEATERS

S. T. JOHNSON CO.
40 years of engineering and building fine Oil Burning Equipment

REZNOR
UNIT HEATER PROTECTION

FOR VITAL WAR
WORKERS EVERYWHERE

TODAY we must protect America's men and women who serve on the production lines. Therefore, these people need heat-comfort so they can work more efficiently with less time off for illness due to fatigue, colds, coughs, etc. Reznor Gas Fired Unit Heaters provide the answer to this problem. Furthermore, Reznor Equipment may be installed at far lower cost with fewer men, and in less time than other types of heaters. They move more warm air during winter and provide greater air circulation during summer—more war production results.

Write today for literature.

REZNOR MANUFACTURING COMPANY
305 James St. **Mercer, Penna.**

"GAS HEATERS EXCLUSIVELY SINCE 1888"

PIPING by the mile
now brazed
with Sil-Fos

Above: A Tee being brazed in prefabricating a section of ship's piping. Below: a cooling unit fabricated completely with Sil-Fos joints.

In military camps, in industri plants, in naval and cargo ships— in fact wherever non-ferrous pip ing is being set up for heating refrigeration or air conditionin —you will find more and more o it being done by brazing wi Sil-Fos.

It's a natural carry-over to wa applications of the wide pre-wa use of Sil-Fos for joining non-fer rous piping—a use that is partic ularly important today for thes reasons:

GREATER SPEED

No threads to cut—no difficu assemblies to make—just clea flux and heat. Sil-Fos brazing ac tually saves months on ship's pip ing jobs.

RELIABILITY

Sil-Fos joints are fully equal t solid pipe in leak-tightness and a essential properties. A Sil-Fo brazed system is, in effect, joint less—one that withstands shock vibration and temperature change without developing leaks.

METAL SAVING

Thread elimination permits use o thinner walled pipe and tubin resulting in important savings o strategic metal. Savings in dea weight are also vital on mobil units.

GET BULLETIN NO. 12

It gives you specific reasons wh Sil-Fos consistently makes lea tight joints with speed, reliabili and economy. Also contains val able metal joining informatio Write for your copy today.

ARMY E NAVY
1ST AWARD
August 1942
2ND AWARD
February 1943

HANDY & HARMAN
82 Fulton St., New York, N. Y.
Agents in Principal Cities
In Canada: HANDY & HARMAN of Canada, Ltd., Tor

On another page in the same publication, Alfred C. Kennedy, president of the National Apartment Owners Association, writes on apartments in the postwar era. In his discussion he says that air conditioning in those climates where the summers are warm seems to be on its way. He expresses the hope that "the costs of installation and operation can be materially lessened before it is forced upon us by tenant demand."

ASTM Standards on Copper and Copper Alloys

This 385 p. book gives in their latest approved form, as of February, 1943, all ASTM standards on copper and copper alloys covering cast and wrought material, alloys used for electrical conductors, and nonferrous metals used in copper alloys. It provides in convenient form specifications widely used throughout industry and by the government. Important features are the emergency alternate provisions and emergency specifications to aid in expediting procurement.

Fifteen of the standards cover copper and copper-alloy wire and cable including the new emergency specification for lead-coated and lead-alloy coated copper wire. There are 13 specifications covering nonferrous metals used in copper alloys such as lake copper, fire-refined copper (other than lake), phosphor tin, nickel, pig lead and the emergency specification covering fire-refined copper, termed "Braden". In the field of copper-plate, sheet and strip, there are 16 specifications which include cartridge brass sheets, case cups, gilding metal, etc.; 15 standards pertain to rods, bars and shapes; and nine to copper pipe and tubes.

A valuable part of the compilation includes the several widely used specifications on copper-base alloys for sand castings and the book is completed by standard methods of test including expansion test (pin test), mercurous nitrate test, hardness conversion table and other test procedures.

This book, with more than 85 standards, in heavy paper cover can be obtained from the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., at $2.25 per copy.

American Standard for Pipe Threads

The American Standards Association, 29 W. 39th St., New York, N. Y., has announced a new American standard for pipe threads, B2.1-1942, which was developed under the sponsorship of the American Society of Mechanical Engineers and the American Gas Association. Copies are available from the ASA for 75c.

The new standard records a number of refinements, some modifications, and a considerable number of additions to the first American standard, which was approved and published in 1919.

Screw Threads and Tap Drill Sizes

The division of trade standards of the National Bureau of Standards, U. S. Department of Commerce, Washington, D. C., has issued a recorded voluntary standard of the trade on screw threads and tap drill sizes. Identified as commercial standard CS24-43, it is for sale by the Superintendent of Documents, Washington, D. C., for 10c.

As announced November 10, 1942, this standard was accepted by the trade as its standard of practice for new production beginning February 10, 1943. It is a revision and consolidation of earlier standards identified as CS24-30 and CS25-30.

OPA Rules for Pricing Solid Fuels

Retailer's bulletin No. 18 of the retail trade and services division of the Office of Price Administration covers coal, coke, and other solid fuels, explaining the main features of revised maximum price regulation No. 122. A copy of the regulation itself may be obtained from district, state, or regional OPA offices.

KRAMER
Products

Coils:
BARE TUBE, FINNED, PLATE.

Condensers:
AIR COOLED, EVAPORATIVE,
WATER COOLED.

Unit Coolers:
COOLMASTER, FREEZING OVEN,
(Electric Defrost)
FREEZING SHOWER,
(Water Defrost)
FLOOR TYPE, RADIAL, PANEL.

●

AIR CONDITIONING UNITS
BLAST COOLING COILS
BLAST HEATING COILS
COMFORT COOLERS
UNIT HEATERS

●

Oil Coolers

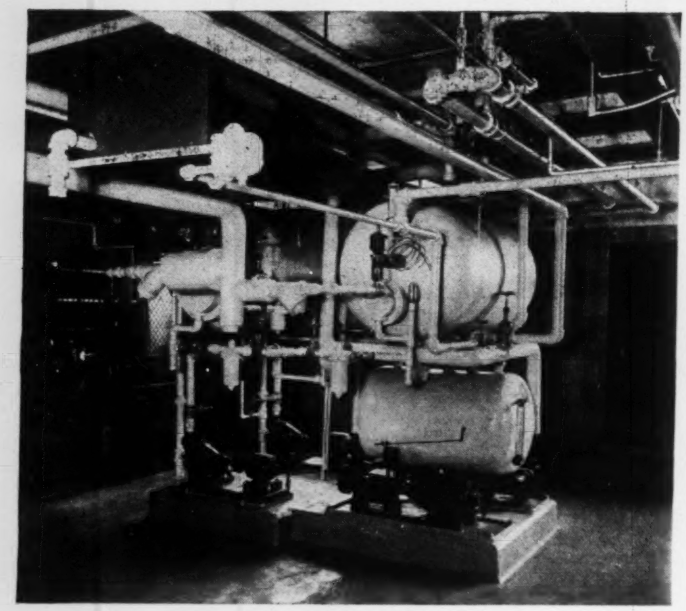
●

Combustion Engine Radiators

●

Kramer System
(Balance Loader)

KRAMER TRENTON CO.
Trenton, N. J.



Power Plant Installation of Two Patterson Hot Water Storage Heaters

Peacetime Equipment
DESIGNED TO
Outlast the War
by PATTERSON-KELLEY

In power plants and war industries . . . on shipboard and in shipyards . . . in army camps and at advanced military bases, Patterson Hot Water Storage Heaters are "on active duty!" Many of them were installed before Pearl Harbor. And because these Patterson hot water storage units were constructed of durable materials, according to exacting specifications, they are giving a good account of themselves — supplying hot water *when* it is needed, *where* it is needed and in the *quantities* needed.

Today, as in the past, Patterson-Kelley is building all types of heat exchange equipment — subject, of course, to W.P.B. allocations of strategic metals. If your preference rating — or that of your clients — does not entitle you to a new Patterson Hot Water Storage Heater, *extra* care must be taken to insure maximum, trouble-free service from existing equipment. And that is where Patterson-Kelley *can* help you — *today*. Our engineers are available to you for free consultation on the care and conservation of all hot water installations. Why not drop us a line today?

EST. PATTERSON-KELLEY HEAT EXCHANGE ENGINEERS 1880

PATTERSON-KELLEY FOR DEPENDABLE ECONOMICAL SERVICE

THE *Patterson-Kelley* CO., INC.
107 WARREN ST., EAST STROUDSBURG, PA.

The bulletin summarizes the fuels affected, sales affected, pricing rules, maximum prices for special sales and adjusted maximum prices, records that must be kept, reports, posting of ceiling prices, sales slips and receipts, and taxes.

Dustless Treatment of Coal

The research laboratories of the Battelle Memorial Institute, Columbus, Ohio, recently issued bulletin No. 5 on The Dustless Treatment of Coals with Calcium Chloride and Other Materials, by Ralph A. Sherman and George W. Lund.

A joint effort of Bituminous Coal Research, Inc., and the Calcium Chloride Association, the bulletin covers the following subjects: Characteristics of calcium chloride, measurement of dustiness index, characteristics of coals investigated, reduction in dustiness by calcium chloride, relation of strength of solution and moisture content of coal to the effectiveness of calcium chloride, permanence of treatment, cause of decrease in effectiveness of treatments, reduction in dustiness by paper mill liquor and calcium chloride, corrosion by calcium chloride, and freezeproofing coal.

Hot Water Supply Boilers

The division of trade standards of the National Bureau of Standards, U. S. Department of Commerce, Washington, D. C., has issued a condensed report of the special conference of February 24 on recommended commercial standard (emergency) for hand fired hot water supply boilers, TS-3438. The standard incorporates certain changes in an earlier version, as a result of the conference.

National Fire Codes for Extinguishing and Alarm Equipment

The NFPA has recently published a 672 p. volume entitled National Fire Codes for Extinguishing and Alarm Equipment. The number and diversity of these standards have become so great that it has been increasingly difficult for the average user, interested in a wide variety of subjects, to keep track of all the standards when separately printed in small pamphlet form.

The present volume brings together for convenient reference the many standards dealing with the various types of fire extinguishing and alarm equipment and related features of supervision, maintenance, and organization. It is divided into sections on automatic sprinklers and water supply; extinguishers and hose; special extinguishing systems; municipal and rural public protection; alarm and supervisory systems; employee organization; and miscellaneous.

Copies may be had from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass., for $3.00.

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 109. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Blow Torches

No. 4397—Series of bulletins on how to light a blow torch, how to clean a blow torch, and how to solder, supplementing a previously issued wall chart describing the various parts of a blow torch.—Turner Brass Works, 823-47 Park Ave., Sycamore, Ill.

Brazing

No. 4398—2 p. bulletin on low temperature brazing with "Sil-Fos" and "Easy-Flo," describing how they may be used to boost output on the war production front.—Handy & Harman, 82 Fulton St., New York, N. Y.

Condensate Return Units

No. 4399—6 p. bulletin (2) on condensate return units, describing their construction features and giving an engineering data and dimension table as well as a list of some recent installations.—Walter H. Eagan Co., 2336-38 Fairmount Ave., Philadelphia, Pa.

Contour Saws

No. 4400—265 p. textbook comprising a comprehensive study of the art of contour machining, the cutting tools, and the manufacturer's training program. Latest techniques for contour machining, internal and external three dimensional parts for short run forgings, multiple identical parts in one operation for short run stampings, and facilities for handling both massive and small jobs are presented as reported from the field. A 44 p. section at the back of the book gives specific information on machine tools and machine shop practice.—Doall Service Co., 1201 Thacker St., Des Plaines, Ill.

Control Equipment

No. 4401—8 p. bulletin (720) on automatic control equipment, including various types of remote and time switches, timers, contactors, program clocks, reversing starters, etc. —Zenith Electric Co., 152 W. Walton St., Chicago, Ill.

Controls

No. 4402—64 p. catalog (600) on automatic controls for heating, air conditioning, refrigeration, and various industrial applications, equipped with hermetically sealed mercury switches. Completely indexed both alphabetically and by type number of the various controls.—Mercoid Corp., 4201 Belmont Ave., Chicago, Ill.

Cooling Towers

No. 4403—20 p. bulletin (603) on conventional type induced draft cooling towers, discussing typical applications, trends and types, construction and design features of the towers, accessory equipment, the properties of redwood, and describing the manufacturer's organization and facilities.—Marley Co., Inc., 3001 Fairfax Rd., Kansas City, Kan.

Deaerators

No. 4404—36 p. bulletin (3005) on tray type deaerators, atomizing deaerators, deaerating hot water generators, and cold water deaerators, with flow diagrams, information on corrosion and pH control, metering data, and information on accessory equipment.—Cochrane Corp., 3131 N. 17th St., Philadelphia, Pa.

Drives, Conveyors, Couplings

No. 4405—179 p. standard equipment catalog (850) on chains, drives, bearings, shafting and accessories, couplings, clutches, pulleys and gears, spray nozzles, conveyor equipment, speed reducers, and other equipment.—Link-Belt Co., 307 N. Michigan Ave., Chicago. Ill.

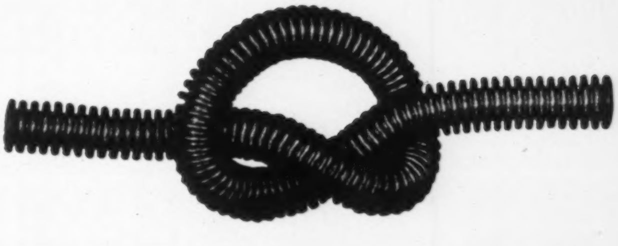
Heaters

No. 4406—Leaflet featuring fan system of heating and air conditioning, and showing cross section of a typical steel plate heater with enclosed blower fan, briefly describing its features.—E. K. Campbell Heating Co., 31st and Dean, Des Moines, Ia.

Heat Exchangers

No. 4407—4 p. bulletin introducing "Shellfin" heat exchangers for use as oil coolers, jacket water coolers, condensate coolers, compressed air aftercoolers, vapor condensers, and for miscellaneous general process duties. Design features are diagrammed and described and a dimension sheet is included.—Downingtown Iron Works, Wallace Ave., Downingtown, Pa.

Here's the Answer to Those "KNOTTY" PROBLEMS of Layout and Vibration!



ECLIPSE

The seamless, flexible, all-metal hose that can literally be "tied in knots" without breaking, or retarding the flow of the substance or material conducted by it. Ideal for intricate installations or those involving movement or vibration. Safe and economical for handling non-solids and non-abrasives at high temperatures and pressures.

STEAM • AIR • ACIDS • GASES
OIL•HYDRAULIC•VACUUM•Etc.

Correct design, the use of proper basic materials, and advanced methods of manufacturing provide, in ECLIPSE, the combination of *flexibility* and *durability* that assures long, low-cost service. *Minimum weight* . . . another feature of this modern hose . . . is accomplished without sacrificing strength or other desirable qualities. Fittings, in wide variety, are easily attached.

When writing for further information, please give the kind of material to be handled, pressures, temperatures, conditions of installation and any other data that will enable our Engineering Department to make proper recommendations.

ECLIPSE AVIATION
SEAMLESS FLEXIBLE METAL HOSE

Manufactured and Sold by
THE INVISIBLE CREW
Precision Equipment by
Bendix
AVIATION CORPORATION
Philadelphia Division

4706 WISSAHICKON AVENUE PHILADELPHIA, PA., U. S. A.

PERFORMANCE PLUS
with
Economy
SCV
Pumps

Economy's new vertical type pump for clear liquid services. Highly recommended for hot and cold water circulation, air conditioning systems, brine circulation, sprinkler equipment, boiler feeding, pressure boosting, etc.

- Vertical in design—saves floor space.
- Motor high and dry—away from splash and dirt.
- Complete rotor easily removed without disturbing piping connections.
- Impeller keyed to extra heavy shaft rotates between both an outboard and inboard bearing—smooth and noiseless operation.
- Built in sizes with discharges 1" to 3", for capacities from 10 to 500 GPM, with heads up to 225 feet.

Write for fully illustrated and complete descriptive Catalog No. D2-1042.

ECONOMY PUMPS, INC.
1011 WELLER AVENUE — HAMILTON, OHIO

on land
on sea and
in the air!...

QUIET MAY
Oil Burner's famed GEROTOR Pump is doing important work

Lathe Maintenance

No. 4408—28 p. bulletin (H-4) on keeping your lathe in trim, the fourth in a series of booklets offered to users and operators to help them get more production.—South Bend Lathe Works, 425 E. Madison St., South Bend, Ind.

Motor Control

No. 4409—16 p. booklet (GEA-4015) comprising a simplified guide to the selection and application of commonly used motor controls, presenting the fundamentals of control and describing the operation and function of the various standard devices which are available. When to use magnetic and manual control, and when reduced voltage starting is necessary, are covered.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Oil Country Tubular Goods

No. 4410—Voluminous looseleaf booklet (57) prepared for use of consumers of oil country tubular goods and including general notes and information on casing; tubing; drill pipe; line pipe; standard, extra strong and double extra strong pipe; charts, formulas and conversion factors; and discussing API field practice for running and pulling tubing, handling drill pipe, transportation, handling and storage, and reconditioning. There is a complete topical index.—Youngstown Sheet & Tube Co., Stambaugh Bldg., Youngstown, Ohio.

Paint Spray Booths and Dust Collection

No. 4411—4 p. bulletin on "Aqua-Restor" paint spray booths and dust collection systems, illustrating and briefly describing their features.—Aqua-Restor Div., Mayer Mfg. Corp., 50 Division Pl., Brooklyn, N. Y.

Piping Pointers

No. 4412—6 p. bulletin, sixth in a series, entitled Short-Cuts to Faster Piping Jobs, with sketches showing how

Heat cleaning tanks faster, easier with CHROMALOX electric units

Tanks holding solutions for cleaning oil and chips from machined parts, quickly gather a layer of sludge at the bottom.

Heating through this insulating layer of sludge is slow and expensive.

Chromalox electric immersion heaters drop down *on top* of the layer of sludge, heating the solution directly.

With thermostat control, they will maintain any required temperature.

They are portable—may be removed when tank is cleaned.

Can be plugged in anywhere that wired power can go.

Can be sheathed in any metal to defeat corrosive properties of heated solution.

CHROMALOX
ELECTRIC IMMERSION HEATERS

Wide variety of types available, for stationary as well as portable use.

Tell us your heating problem. Write for the Chromalox Catalog of Electric Heat.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

to meet piping material shortages and giving examples of wartime piping ingenuity which are of interest both to piping specifiers and pipe fitters.—Crane Co., 836 S. Michigan Ave., Chicago, Ill.

Piping's Romance

No. 4413—12 p. issue of Sparks, the third of this series of publications, featuring the romance of piping from 5,000 years ago to today, condensed into 20 minutes' interesting reading and illustrated with photographs and authentic drawings. The story concludes with a few paragraphs on welding fittings and it is shown that piping systems today are vital to all industry.—Tube Turns, 238 E. Broadway, Louisville, Ky.

Proportioning Equipment

No. 4414—8 p. bulletin (4009) describing proportioning equipment of the double displacement type, which eliminates pumps and moving parts. The proportioning is by displacement in which two tanks are utilized, the chemical solution being separated from the water by a line of thin oil such as kerosene.—Cochrane Corp., 3131 N. 17th St., Philadelphia, Pa.

Railway Air Conditioning

No. 4415—A large check chart on the maintenance of railway air conditioning equipment showing the points to check, when to service, and the proper servicing method for both mechanical and water ice systems. Also, railway air conditioning maintenance tag check list for both types of systems and for winter and summer operation.—B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass.

Rustproofing

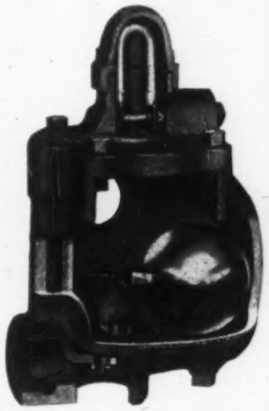
No. 4416—Folder explaining the uses and methods of application of two rustproofing compounds used for the protection of machine parts, castings, stampings, fabrica-

FOREMOST RUBBER COMPANY NEEDS ENGINEERS IMMEDIATELY

An unusual opportunity is extended to graduate engineers to become members of our Central Engineering Department. Experience is required in the industrial application of heating, ventilating, exhausting, air conditioning and refrigeration. Also needed are mechanical design engineers, process and chemical engineers.

The company now engaged in essential war work offers great futures after the war. Engineers not using all their abilities in the war effort will find this opportunity very much worth while.

Replies (to be treated confidentially) should include a full-length description of education, experience and background. Please include photograph. Address Box No. 365-A, Heating, Piping & Air Conditioning, 6 North Michigan Ave., Chicago, Ill.



HAINES

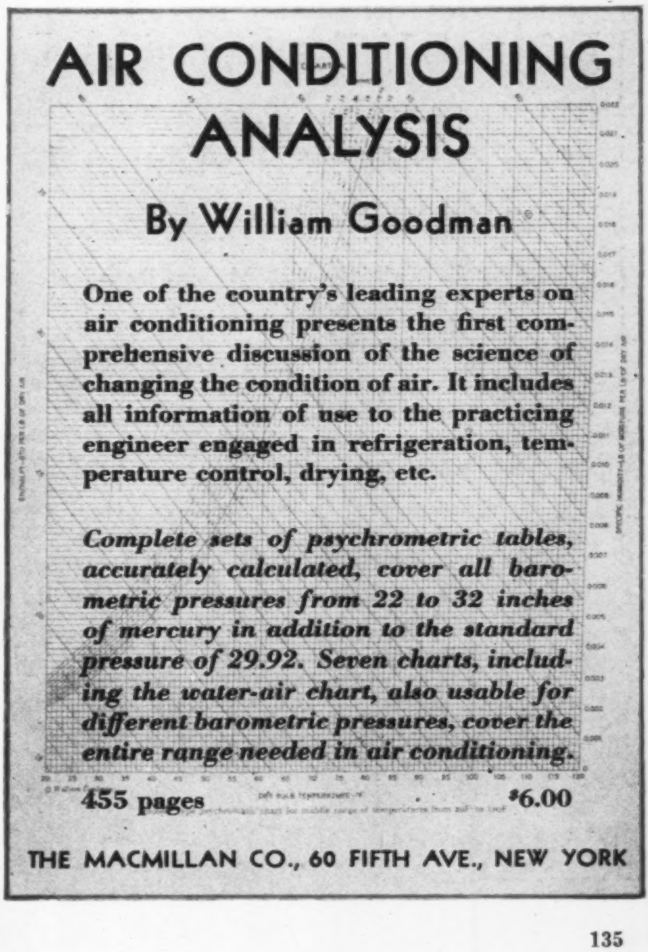
FLOAT and THERMOSTATIC TRAPS

employ the Bourdon Tube as the operating member which is the strongest thermostat ever built into a Steam Trap.

The thicker wall of the tube is the reason for the greater strength. The simplicity of the trap plus the strength of the tube is the secret of the long life of our traps.

Made in ¾" - 1" - 1¼" and 1½"

WILLIAM S. HAINES & CO.
460 N. TWELFTH ST.
PHILADELPHIA



AIR CONDITIONING ANALYSIS

By William Goodman

One of the country's leading experts on air conditioning presents the first comprehensive discussion of the science of changing the condition of air. It includes all information of use to the practicing engineer engaged in refrigeration, temperature control, drying, etc.

Complete sets of psychrometric tables, accurately calculated, cover all barometric pressures from 22 to 32 inches of mercury in addition to the standard pressure of 29.92. Seven charts, including the water-air chart, also usable for different barometric pressures, cover the entire range needed in air conditioning.

455 pages **$6.00**

THE MACMILLAN CO., 60 FIFTH AVE., NEW YORK

WANTED

DEVELOPMENT ENGINEER

We have an attractive opening for a design engineer familiar with control valves, steam specialties, and industrial instruments.

He will be engaged in vital war work now with prospect of permanent position of great future promise.

He should be a graduate engineer with several years' actual experience in the design and manufacture of high grade valves for pressure, temperature, level and flow control, and related devices.

Application with detailed information on qualifications and requirements must be by letter headed "Development Engineer" and addressed to W. L. Towne, 10 East 40th Street, New York, N. Y.

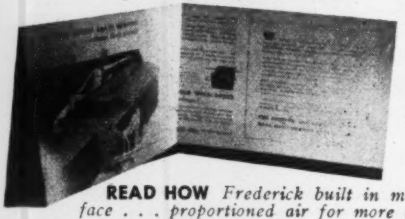
SARCO
SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
SARCO CANADA LTD., FEDERAL BLDG., TORONTO, ONT.

REDESIGNED FREDERICK STOKERS CORRECT MANY COMMON STOKER FAULTS!

Stoker operators told us what they didn't like . . . Our engineers went to work to improve, and to eliminate objectionable features . . . And . . .

THESE LATEST DEVELOPMENTS IN INDUSTRIAL STOKERS ARE *fully described..* in a folder that tells, in detail, how and where we built in many new features for thrift and convenience! If your work is war essential, we'll be glad to send you this folder.



READ HOW *Frederick built in more active grate surface . . . proportioned air for more thorough combustion . . . simplified installations . . . and engineered many other improvements to correct common stoker deficiencies!*

CLIP THIS COUPON AND MAIL TO

Send a copy of your new Stoker Folder to

NAME ....
COMPANY ....
ADDRESS ....

The FREDERICK IRON & STEEL CO.
East & Seventh Sts., Frederick, Maryland

Centrifugal Pumps for All Purposes

tions, assemblies, etc.—Black Bear Co., Inc., 23-01 44th Dr., Long Island City, N. Y.

Testing Chambers

No. 4417—12 p. bulletin on "Tenneyzphere" high altitude chambers, constant and variable temperature baths, humidity chambers, and all weather rooms. Units are built to order for temperatures ranging from —90 F to +320 F, relative humidity to 95 per cent. The equipment is described and illustrated in detail and an extensive tabulation of users of the chambers is presented which shows the use, working space, temperature range, humidity range, and air pressure employed.—Tenney Engineering Inc., 46 Farrand St., Bloomfield, N. J.

Unit Heater Maintenance

No. 4418—Wall chart on unit heater maintenance telling the vital points, and covering inspection required, cleaning and lubrication of motors, overload protection, cleaning the condenser, internal corrosion safeguards, and cleaning the casing.—Modine Mfg. Co., 1772 Racine St., Racine, Wis.

Valves

No. 4419—36 p. bulletin (A-4) on globe and check valves, covering bronze and forged steel globe valves, balanced stop valves, and bronze, forged steel and cast steel check valves. There are three pages of steel pipe data, data on discharge of water to atmosphere for circular straight edge orifices, and pipe thread dimensions.—Watson-Stillman Co., 140 Aldene Rd., Roselle, N. J.

V Belts

No. 4420—8 p. bulletin on "Veelos" v belts, describing their advantages, applications, construction, and giving information on installation, belt lengths, ratings, and method of engineering v belt drives.—Manheim Mfg. & Belting Co., Manheim, Pa.

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

NoDrip A SURE CURE

● This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition surfaces. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance. A gallon covers about 30 feet of 1" pipe. Dries in 24 hours. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House.

FREE ***NoDrip Handbook. All about Condensation Drip and its Prevention.***

APPLY WITH BRUSH, TROWEL OR SPRAY

J. W. MORTELL CO.
Technical Coatings Since 1895
512 BURCH ST. KANKAKEE, ILL.

Ventilation in Shipyards

No. 4421—8 p. bulletin on hull ventilation in shipyards, by Charles B. Molloy, covering local exhaust, the safety zone, air volume requirements, air velocity and hose size, friction losses, exhauster types, exhauster specifications, centrifugal type characteristics, ventilation by dilution, and maintenance and operation of fume exhaust equipment.—General Blower Co., 401 N. Peoria St., Chicago, Ill.

Ventilators

No. 4422—12 p. bulletin on "Asbo" ventilators made of asbestos protected metal or other approved materials, describing the design and its advantages, giving standard dimensions, and presenting a series of tables of cfm capacities for estimating purposes.—American Steel Band Co., Bowman Bldg., Pittsburgh, Pa.

Wartime Engineering

No. 4423—32 p. booklet with many interesting examples of wartime engineering and showing the use of many peacetime products in war work.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Welding

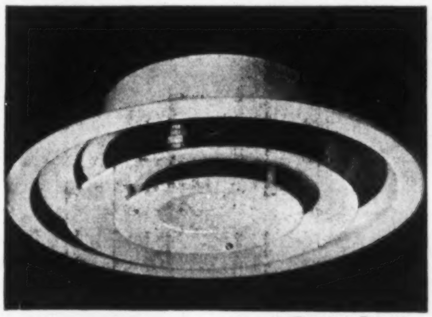
No. 4424—Oxyacetylene flame adjustment chart, showing natural color photographs which aid the student in obtaining the correct flame adjustment; the five fundamental flame adjustments shown are acetylene burning in air, a strongly carburizing flame, slight excess of acetylene flame, neutral flame, and an oxidizing flame. Also, reprint of a series of articles by Arthur N. Kugler on the welding of piping.—Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.

Welding Positioners

No. 4425—Leaflet illustrating welding positioners and telling briefly how they increase production.—Ransome Machinery Co., Dunellen, N. J.

KNO-DRAFT K-NEWS
HOW TO DO A BETTER JOB FOR LESS!

The Kno-Draft* type W-A-R Air Diffuser points the way—redesigned to obtain even better performance while cutting the material in half—and passing on the savings in dollars too.



Patents Pending

All of the Kno-Draft exclusive features are retained—draftless and noiseless uniform air diffusion—thorough air mixing—room temperature equalization—greater air volumes with lower resistance.
Also, **adjustability** to suit the season or the job.

**Formerly known as Dorex Kno-Draft Air Diffuser*

WB CONNOR ENGINEERING CORP.

W. B. CONNOR ENGINEERING CORP.
114 East 32nd Street New York, N. Y.

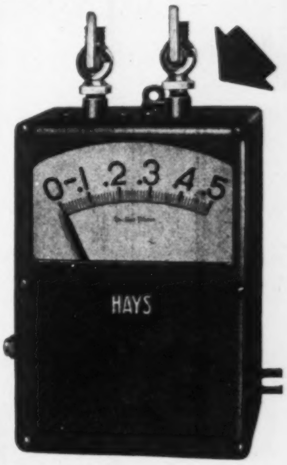
WARNS WHEN AIR-FILTER CLOGS WITH DIRT

DIRT clogged filters in the air circulating system mean reduced efficiency and added power costs. On the other hand, changing filters oftener than necessary represents money wasted.

Install a Hays Air-Filter Gage and know exactly just how dirty and inefficient your filters are. An indicator shows the air resistance at all times. When the resistance becomes excessive an alarm is sounded or signal flashed. A high quality precision instrument by pioneer instrument makers. Write 990 Eighth Avenue, Michigan City, Indiana for special bulletin 37-278.

HAYS AIR-FILTER GAGE

TELLS CONDITION OF FILTER AT ALL TIMES



The HAYS CORPORATION
SINCE 1903
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

GREEN LIGHT FOR INDUSTRY

*SARAN PLASTIC PIPE, TUBING, FITTINGS

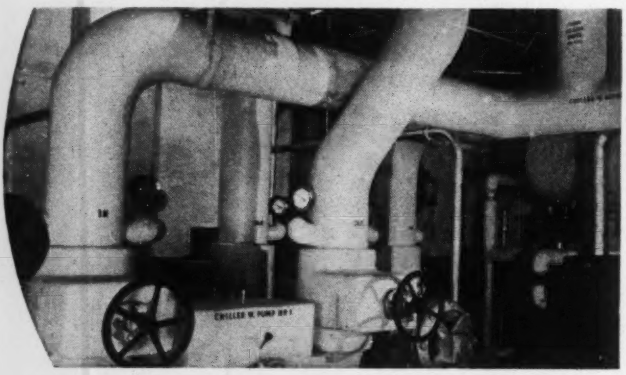
SARAN by HODGMAN is a tough thermoplastic specially made to replace strategic materials. It is adaptable for use under high working and bursting pressures and is resistant to most chemicals. Its ease of handling makes it extremely valuable in installations requiring the transport of oil, gas and corrosive chemicals.

*Pat. No. 2160931

Send FOR COMPLETE INFORMATION SHEET AND FREE SAMPLE

HODGMAN RUBBER CO.
FRAMINGHAM, MASS.
NEW YORK 261 Fifth Avenue
CHICAGO 412 South Wells St.
SAN FRANCISCO 121 Second St.

CORK INSULATION
Now Available for Air Conditioning!
(NO PRIORITY REQUIRED)

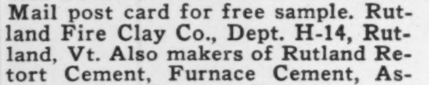


Mundet Cork Pipe Covering is made of 100% pure cork, which, due to its low conductivity, holds power costs to the minimum. Its high efficiency permits precise control of low temperature regardless of climate or season • Cold lines, low-temperature ducts, the walls, floors and ceilings of refrigerated rooms should be adequately protected by Mundet Cork Insulation in the form of Cork Pipe Covering and Corkboard • For test data, showing what Mundet Cork Insulation means in savings and operating efficiency, write to Mundet Cork Corporation, Insulation Division, 65 South Eleventh Street, Brooklyn, New York.

MUNDET CORK
INSULATION
CONSERVES LOW TEMPERATURE

SAVES MONEY...
BECAUSE MORE BULK PER POUND

No wonder master piping contractors and plant engineers have O.K.'d Rutland Pipe Joint Cement for 30 years. It seals joints tightly—last indefinitely—yet always leaves pipes easy to disjoin. Legal for use in all cities because no toxic ingredients. Remains soft in can. Does not stain hands or fixtures. Mail post card for free sample. Rutland Fire Clay Co., Dept. H-14, Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.



Coming Events

Power Conference

Midwest Power Conference: April 8-9, Palmer House, Chicago, Ill. Papers scheduled include Breaking Bottlenecks in Piping Materials, by G. W. Hauck, Crane Co.; The Fuel and Heating Program at Army Cantonments, by Lt. Col. L. C. McCabe; Possibilities and Limitations of Small Hand Fired Furnaces, by J. R. Fellows, University of Illinois; Conversion from Oil to Coal Fired Steam Generation, by S. I. Rottmayer; and Effect of Coal Sizing on Efficiency and Operation of Mechanical Stokers, by Otto de Lorenzi, Combustion Engineering Co. Sponsored by Illinois Institute of Technology with the cooperation of nine other schools and seven local professional engineering sections. The conference director is Stanton E. Winston, professor of mechanical engineering, Illinois Tech, 3300 Federal St., Chicago, Ill.

Refrigeration Equipment

Refrigeration Equipment Manufacturers Association: Annual meeting, April 13-14, Palmer House, Chicago, Ill. This is to be an "all-industry wartime conference" attended by jobbers, service engineers, and representatives from the refrigeration section of the WPB, including Sterling Smith. R. Kennedy Hanson, 1107 Clark Bldg., Pittsburgh, Pa., is executive secretary of the REMA.

Foundry War Production

American Foundrymen's Association: 47th annual meeting, April 28-30, Hotels Jefferson and Statler, St. Louis, Mo. Meeting is to be a "mobilization of management, technical, and operating men for devising ways and means for extending use of cast metals in the war effort." Headquarters office of the AFA is at 222 W. Adams St., Chicago, Ill.

Refrigerating Engineers

American Society of Refrigerating Engineers: 30th spring meeting, June 1-2, Hotel Statler, Cleveland, Ohio. Low temperature refrigeration is to be stressed. Headquarters office of the ASRE is at 50 W. 40th St., New York, N. Y.

Smoke Prevention

Smoke Prevention Association: 37th annual meeting, June 8-11, Hotel William Penn, Pittsburgh, Pa. The program includes papers on probability of error in sampling coal, by Henry F. Hebley, Pittsburgh Coal Co.; smoke tendencies of coals, by H. J. Rose, Mellon Institute of Industrial Research; smoke from the viewpoint of the chemist, by E. Berl, Carnegie Institute of Technology; collection of fly ash from spreader stokers, by K. H. Bowman, Dravo Corp; determination of fly ash, by D. D. Pendleton, Buel Engineering Co.; and railroad smoke control in Pittsburgh, by W. H. Kimberly, Pittsburgh Bureau of Smoke Prevention. Sumner B. Ely is chairman of the arrangements committee. Headquarters office of the SPA is at 139 N. Clark St., Chicago, Ill.

District Heating

National District Heating Association: 34th annual meeting, June 9-10, Hotel Schenley, Pittsburgh, Pa. This is to be a "strictly technical meeting devoted to wartime problems of the steam utilities," with 12 committee reports and 28 papers. Secretary-treasurer of the NDHA is John F. Collins, Jr., 827 N. Euclid Ave., Pittsburgh, Pa.

Look on the roof of

The Best Heated Building in Town

Here is the symbol of heating "Controlled-by-the-Weather."

It is the Outdoor Thermostat of the Webster Moderator System, an automatic central control that is saving precious fuel for hundreds of America's best heated buildings and releasing much needed transportation facilities for other purposes.

The Webster Moderator System supplies steam *continuously* to all radiators, automatically changing the heating rate with changes in outdoor temperature. No "off" and "on" heating. No annoying "now hot — now cold" conditions.

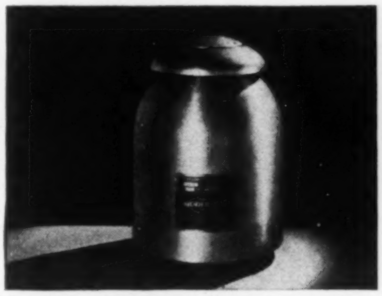
"Control-by-the-Weather" prevents wasteful overheating . . . reduces costly window opening in periods of mild weather. Radiator temperatures may vary from 212° to 150°, or even as low as 90°, depending on the need for heat.

The Webster E-4 Moderator System is a steam heating control that anybody can understand. There are just four control elements—an Outdoor Thermostat, a Main Steam Control Valve, a manual Variator and a pressure Control Cabinet. These elements, plus small metering orifices to assure each radiator its share of steam, result in the highest expression of comfort and economy in modern steam heating.

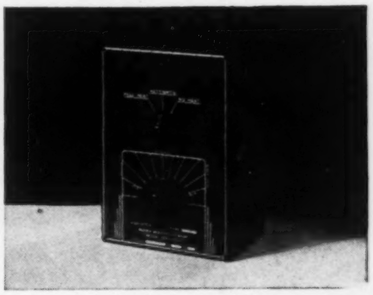
WARREN WEBSTER & CO., Camden, N. J.
Pioneers of the Vacuum System of Steam Heating : : Est. 1888
Representatives in principal U. S. Cities : : Darling Bros., Ltd., Montreal

ARMY E NAVY

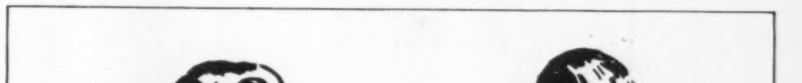
Webster
Steam Heating



Outdoor Thermostat automatically changes heating rate when outdoor temperature changes.



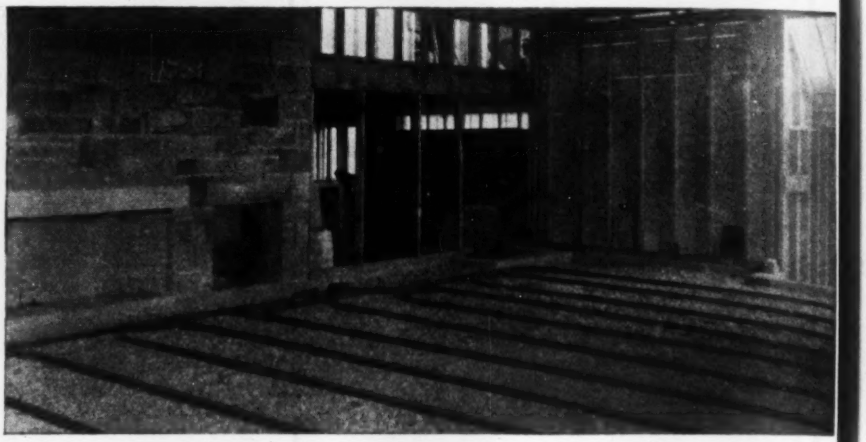
Variator provides desirable manual operation to supplement automatic control.



For men who are planning building construction or modernization both now and after the war, we have a free book giving case studies of 268 modern steam heating installations—banks, hospitals, hotels, apartments, office buildings, industrial plants, large buildings of every type. These are reports on actual installations of the Webster Moderator System, with photographs of buildings, proof of heating comfort, savings in dollars and cents. Study this 75-page book at your leisure. Your nearest Webster Representative will call only if you invite him. Write for "Performance Facts" today.

Here is one man's answer to the question of

Radiant heating for 2-story homes



BYERS WROUGHT IRON

JOHN W. LINCOLN, Architect and Engineer

What an architect puts in his *own* home is always news—and in the case of the John W. Lincoln residence, Stonington, Conn., it takes on added interest. This house provides one architect's answer to a question many architects have asked: what about Radiant Heating for 2-story structures?

The residence is 2-story, 9-rooms, and was completed in the spring of 1942. Pipe coils were fabricated from Byers Wrought Iron Pipe: 700 feet of 1¼ inch, and 400 feet of ¾ inch. These footages include all supplies and returns. First-floor coils were laid on a gravel bed, and topped with 3 inches of concrete; floor covering is asphalt tile. Second-floor coils are fastened to ceiling joists, with insulation above. Heating boiler is stoker-fired hot water, with circulating pump.

The unusually cold winter just past gave the system an immediate and severe test, with temperatures that dropped to 15 to 20 degrees below zero. Mr. Lincoln reports "entire satisfaction."

The steadily accelerating use of Radiant Heating has provided dozens of case histories that make it unnecessary to theorize about its advantages, its planning or its installation. Past experiences have also made it unnecessary to guess or gamble in selecting durable materials for the pipe coils. Byers Wrought Iron has served for many years in applications where identical corrosive conditions existed, and its unusual durability is recorded in the files and in the minds of users. When you are thinking of Radiant Heating, think of Byers Wrought Iron.

Do you have our technical bulletin "Byers Wrought Iron for Radiant Heating Installations"? It gives you in condensed form a wealth of information on the calculation and installation of these systems. We will gladly send you a complimentary copy on request.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Corrosion costs you more than Wrought Iron

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1943, Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.

Speed Regulation for Motors

No. 2434—For application on industrial drives, such as machine tool feeds, winding reels, conveyors, fabricating and converting machinery and other equipment, a new electronic adjustable speed drive, the "Mot-O-Trol," provides close speed regulation over a 20 to one speed range for d-c motors operating from an a-c source.

Features of the electronic drive include stepless speed control, automatic close speed regulation over wide load fluctuations, full torque at extremely low speeds, smooth stepless acceleration and deceleration and dynamic braking, says the maker. At present, a standard drive is available for ratings up to 1 hp for single phase operation on 110 or 220 volt, 60 cycle systems. Special drives of larger horsepower rating can be designed to suit particular application requirements.

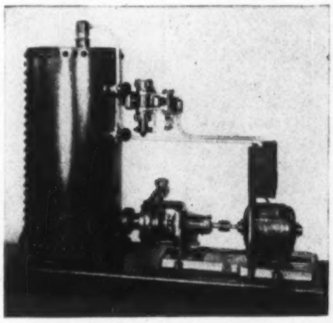
This new drive has four parts. These are (1) power transformer for separate mounting, (2) cabinet with the thyratron tubes and the current limiting and speed regulating control, (3) control station with potentiometer to vary the voltage supplied to the armature and field circuits and with start and stop pushbuttons, and (4) shunt wound d-c motor.

The standard unit is designed to regulate automatically a preset motor speed so as to maintain essentially constant speed regardless of load. The d-c voltage output of the main rectifier tubes is controlled by small tubes to compensate for speed changes. For a speed range of 10 to one, with torque varying from no load to full load, speed will not vary more than 4 per cent from a preset value. Maximum variation for the 20 to one speed range is within 8 per cent. No additional rotating part, other than the d-c motor is required. No separate line starters or field rheostats are necessary.—Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

Boiler Feed Systems

No. 2435—Because a high temperature boiler feed system has proved effective in helping wartime industry reduce pumping and maintenance costs, and save fuel, an expansion of the line has been announced, says the maker.

All sizes of the system are now available with either a standard coupled type of pump, or the close coupled type originally furnished. In addition, a new larger size of the pumping unit has been developed, making the system available for use with boilers from 30 hp to 500 hp, operating at pressures up to 150 psi.



The standard coupled type of pump is being offered for those installations where space is not at a premium, and where greater ease in servicing or testing the motor is desired. It permits the use of a standard type motor, which simplifies replacement if ever this should be necessary.

The new pumping unit, like the original close coupled type, employs the "pressure equalizing" principle of operation. Instead of fighting against boiler pressure, the system admits this pressure to an equalizing chamber behind the pump during operating cycles, which leaves only the task of raising the returned condensate a few feet to the boiler water level.

Savings in fuel are obtained by venting the equalizing chamber of the pump unit to the condensate receiver. This makes it possible to maintain a slight controlled pressure on the returns. Condensate consequently can be returned to the boiler at higher temperatures than is possible under atmospheric pressure or vacuum conditions, it is said.

Motionless metal electrodes are placed at the boiler water line to signal the pump whenever the boiler needs water. An automatic vent on the condensate receiver disposes of air and noncondensable gases picked up in the system. An auxiliary water level control in receiver adds make up water to the system whenever necessary.—Johnson Corp., 892 Wood St., Three Rivers, Mich.

Nonmetallic Pipe

No. 2436**—A new line of nonmetallic drain and sewer pipe, requiring no critical war materials, is made of cellulose fiber impregnated with coal tar pitch. The pipe is said to be resistant to moisture, tuberculation, root growth, corrosion, and most dilute inorganic acids and alkalies. Couplings maintain pipe lengths in line and provide tight joints if desired.

Oil companies in Texas, Oklahoma, and other fields have installed over a million feet of this pipe in connection with salt water disposal. The pipe is manufactured in perforated and nonperforated form. The perforated pipe is designed especially for septic tank filter beds and foundation footing and field drainage.—Fibre Conduit Co., 292 Madison Ave., New York, N. Y.

Portable Dust Collector

No. 2437**—A new portable dust collector, known as the "Safe-Aire," has been developed. This machine is designed to provide a simple, flexible, and inexpensive dust collection

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [5-43]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature.

(Circle each number in which you are interested):

2434 2435 2436 2437 2438 2439 2440 2441 2442 2443
2444 2445
4426 4427 4428 4429 4430 4431 4432 4433 4434 4435
4436 4437 4438 4439 4440 4441 4442 4443 4444 4445
4446 4447 4448 4449 4450 4451 4452

Name........................... Title.............

Company ....

Address ....

City.............................. State..........

LAST YEAR'S BONDS GOT US STARTED

THIS YEAR'S BONDS

ARE TO WIN!

★ Last year saw nearly 30,000,000 workers voluntarily buying War Bonds through some 175,000 Pay-Roll Savings Plans. And buying these War Bonds at an average rate of practically 10% of their gross pay!

This year we've got to top *all* these figures—and top them handsomely! For the swiftly accelerated purchase of War Bonds is one of the greatest services we can render to our country . . . and to our own sons . . . and our neighbors' sons. Through the mounting purchase of War Bonds we forge a more potent weapon of victory, and build stronger bulwarks for the preservation of the American way of life.

"But there's a Pay-Roll Savings Plan already running in my plant."

Sure, there is—but how long is it since *you've* done anything about it? These plans won't run without winding, any more than your watch! Check up on it today. If it doesn't show substantially more than 10% of your plant's pay-roll going into War Bonds, it needs winding!

And you're the man to wind it! Organize a vigorous drive. In just 6 days, a large airplane manufacturer increased his plant's showing from 35% of employees and 2½% of pay-roll, to 98% of employees and 12% of pay-roll. A large West Coast shipyard keeps participation jacked up to 14% of pay-roll! You can do as well, or better.

By so doing, you help your nation, you help your workers, and you also help yourself. In plant after plant, the successful working out of a Pay-Roll Savings Plan has given labor and management a common interest and a common goal. Company spirit soars. Minor misunderstandings and disputes head downward, and production swings up.

War Bonds will help us win the war, and help close the inflationary gap. And they won't stop working when victory comes! On the contrary—they will furnish a reservoir of purchasing power to help American business re-establish itself in the markets of peace. *Remember, the bond charts of today are the sales curves of tomorrow!*

You've done your bit Now do your best!

THIS SPACE IS A CONTRIBUTION TO AMERICA'S ALL-OUT WAR EFFORT BY

system for plants where dust control is needed, says the manufacturer. It can be used either to supplement larger, permanent dust control systems, or to serve in place of such systems when necessary.

Its basic use is to collect dust from a single grinder or other dust making machine, separate the dust from the air, and blow the clean air directly back into the shop. It will normally handle the dust from two 9 in. grinding wheels, whether they are mounted together or separately, and it can be attached to two separate machines, it is stated.

It has a capacity of 600 cfm, and one of its advantages is that it does not exhaust any air from the shop, but returns it approximately 97 per cent clean and slightly warmer than before. It is powered by a ⅛ hp motor running an Ilg blower at 3400 rpm. The machine stands 37 in. high, is 27 in. wide, and 13 in. deep. Installation involves no piping other than a short length required to attach the dust collector to the machine guard or hood. It weighs less than 120 lb.

The unit sucks the dust laden air from a grinding wheel, buffing wheel, or other dust making tool and forces it at high speed into a miniature cyclone which precipitates the heavier dust into a hopper and throws the lighter dust into a filter chamber. The air is then forced through a spun glass filter directly back into the shop. The filters, which are standard size, are the only parts of the machine which require periodic replacement.—Bargar Sheet Metal Co., Cleveland, Ohio.

Electric Heaters Supplement Boiler

No. 2438—Electric heat has provided the answer to a problem at Haag Brothers, Inc., which company, engaged in the meat packing business, recently installed an air conditioned oven for smoking meat. Supplementary equipment includes a smokehouse conditioner which furnishes smoke and properly heated and humidified air to the oven.

The conditioner must be provided with 400 lb per hr of steam at 50 psi gage pressure to heat the air to a temperature of 240 F as it circulates over an arrangement of finned steam coils. This ordinarily calls for a high pressure steam plant.

It was found, however, that the existing structure was

Careyduct in new studios of radio stations WLW and WSAI

Eliminate METAL DUCTS IN AIR CONDITIONING

with *Careyduct*

THE ALL-ASBESTOS INSULATED DUCT

Even before the war curtailed the use of metal, CAREYDUCT had won an enviable position in the air conditioning industry for its many outstanding advantages over insulated steel duct. Under present conditions, the fullest utilization of this all-asbestos duct is more essential than ever. In a recent job, over 65 car-loads of CAREYDUCT saved 1,500,000 lbs. of steel.

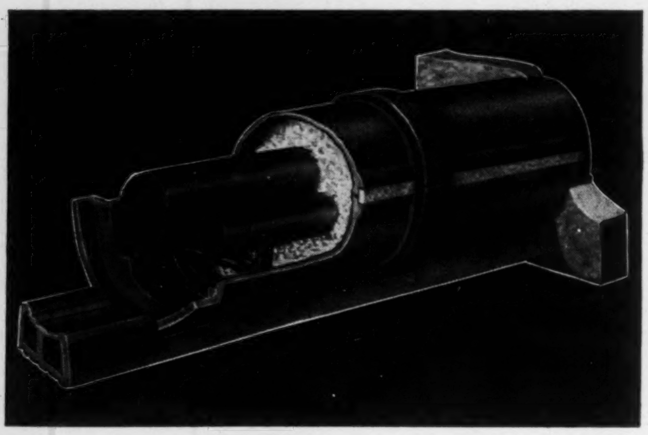
It has been demonstrated in hundreds of installations that the use of CAREYDUCT means greater efficiency . . . quieter operation . . . lower friction . . . lighter weight . . . easier installation . . . and actually lower cost than insulated metal.

CAREYDUCT is a natural sound absorber and non-conductor of sound. It hushes fan noises; reduces outside noise; eliminates metallic "cracking"; by effectively subduing noise, it allows use of smaller sizes with higher velocities; solves many difficult problems where space is limited.

Write for Careyduct Manual. Address Dept. 25

THE PHILIP CAREY MFG. COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
IN CANADA THE PHILIP CAREY COMPANY LTD Office and Factory LENNOXVILLE P Q

ADSCO BANNON TILE CONDUIT
Protects underground Pipe Lines



NO WORKING IN CLOSE QUARTERS TO PUT PIPE TOGETHER

● Split tile construction makes it easy to install a group of pipes in one conduit. Pipe can be threaded or welded where you can get at it then laid on the supports. These can be furnished for several combinations of pipe in the same conduit thereby reducing costs.

AMERICAN DISTRICT STEAM COMPANY
N. TONAWANDA, N. Y.
MAKING "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 60 YEARS

DESIGNED WITH A BASE DRAIN

Designed with base drain to carry away ground water seepage . . . also any water within, so pipe can be put together with ordinary threaded connections. Send us details of proposed installation for prompt quotation or write for illustrated bulletin.

too small to accommodate a high pressure boiler, and there was no room on the grounds for a new building. The only type of boiler which could be installed in the available space was a low pressure sectional type boiler with 15 psi gage pressure maximum.

The smokehouse conditioner could heat air to only 200 F at this pressure, which was insufficient to operate the oven properly. It was necessary, therefore, to boost the air temperature by a minimum of 40 F by other means. Electric heat was called upon to do this, since a constant and quick heat supply was needed.

Eight General Electric finned "Calrod" heaters, with a total connected load to 48 kw, were installed in the circulating ducts through which the air passes from the conditioner to the oven. The heaters were installed immediately beyond the steam coils, and were arranged with hand controlled switches so that the operator can select the heat volume to satisfy any demand, depending upon the work being done in the oven.

The low pressure boiler is now doing the job. In addition, the cost of operation is less than the estimated cost for operating a high pressure boiler. The oven and smokehouse conditioner were furnished by Niagara Blower Co.

Thirty Inch Welding Elbows

No. 2439—Illustrated here is a 30 in. seamless welding elbow to be used in a seagoing drydock, said to be the largest seamless elbow ever made. The 180 deg return shown in the picture can be used as such, but in this particular instance it will be cut apart into two 90 deg ells.

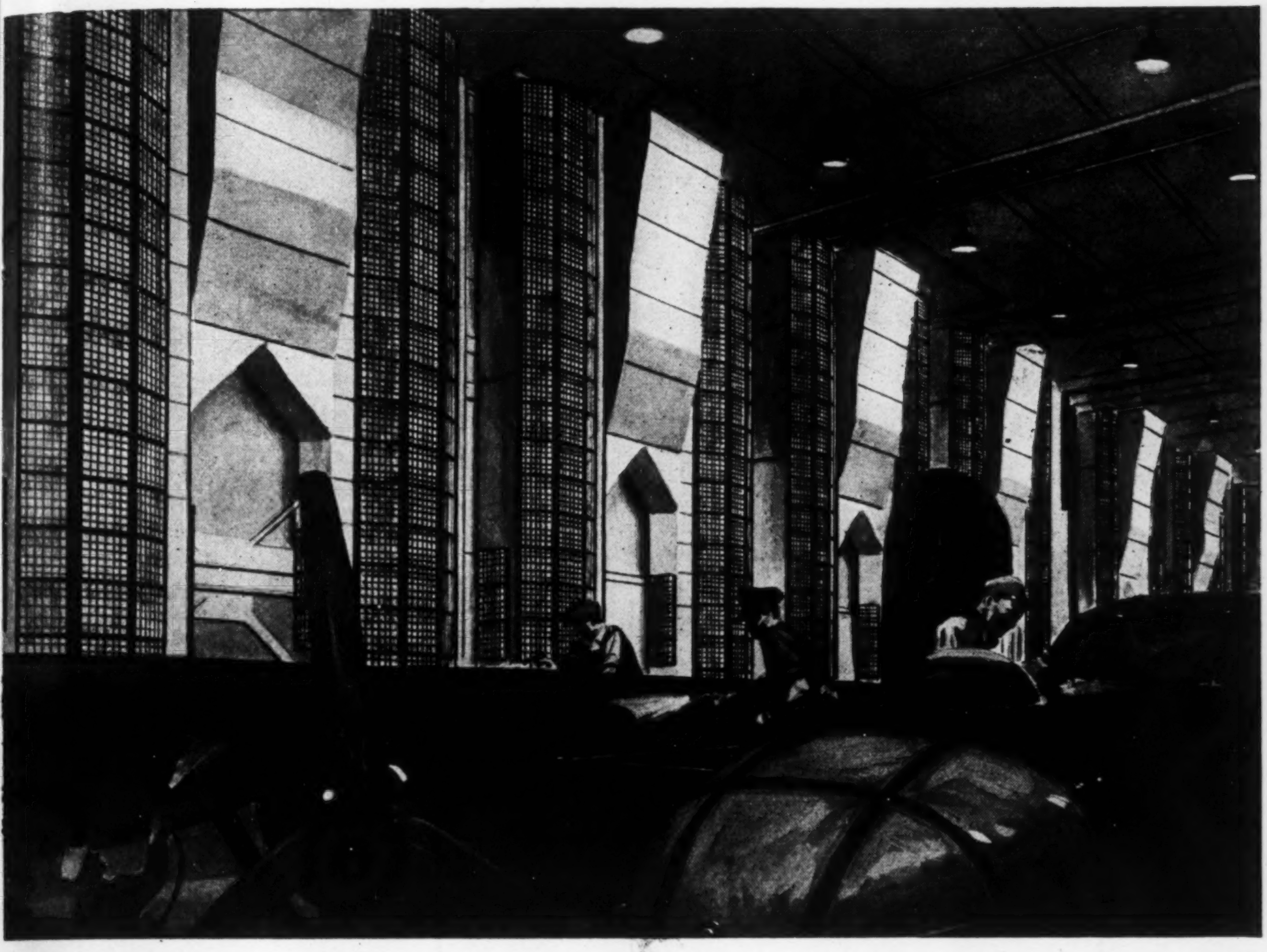
Essentially, a floating drydock is a huge hollow platform that partly submerges, by letting water inside, until the ship to be serviced is floated above it; then it rises by pumping out the water from its hollow interior until the ship is no longer afloat. Batteries of large pumps force the water out through the 30 in. welded pipe lines in which these elbows are used.

According to the manufacturer, erection time and weight are saved by using welded construction for this piping.—Tube Turns, Inc., 238 E. Broadway, Louisville, Ky.

Ventilated Locker Rooms

No. 2440—Locker rooms planned to provide for complete drying of workers' clothes, while hanging within ventilated locker cabinets, are being installed in several large industrial plants designed and under construction by The Rust Engineering Co., Pittsburgh, Pa.

Purpose is to effect a modern solution for drying, between shifts, of workers' clothes which become saturated with perspiration owing to extreme heat conditions. The customary method heretofore has been to place the clothing on racks or baskets which are elevated to the ceiling on a pulley arrangement and locked in place. This method has several drawbacks, the most impelling of which is that the metal for the racks has become largely unobtainable.



You are looking at the largest paint-spray booth in the world, where complete 4-engine bombers are painted in one operation. To the left you see part of the Dust-Stop air-filter installation through which 700,000 CFM moves. The filter bank consists of 3648 Dust-Stops.

How Dust-Stop Air Filters help in aircraft painting

Spray-painting planes is now a matter of camouflage, not looks.

So—keeping the dust out of the air in a paint-spray booth is still highly important.

For painted wing and fuselage surfaces must be as smooth as possible. A surface roughened by dust could impair the aerodynamic efficiency of a plane. Then, too, clean filtered air is required to insure the paint operators efficiency by helping provide ideal working conditions.

The reasons why Dust-Stop* Air Filters are used in the largest paint-spray booth in the world (pictured above) are obvious: high efficiency, low installation and maintenance costs, and easy availability of replacement filters.

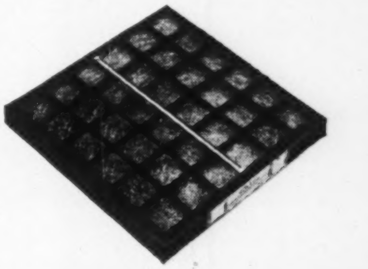
As original equipment for commercial and industrial installations, Dust-Stops cost only about 1¢ per CFM to install. They cost less than 1/10th of a cent per CFM to replace.

It is the combination of these points of superiority that makes Dust-Stops the Number 1 air filter in plants making bomb sights, tanks, precision instruments, and in nearly every other type of war industry.

If you have an air-filtering problem, Dust-Stops can probably help you. Write today for complete engineering data and information.

Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.

ARMY E NAVY



FIBERGLAS* DUSTOP* AIR FILTERS

*T. M. Reg. U.S. Pat. Off.

EXTRUDED PLASTICS, Inc.
New Canaan Avenue Norwalk, Conn.

Progress Report
2½"

TULOX *Seamless*
REG. U.S. PAT. OFF

PLASTIC TUBING

Made to close tolerances from a number of base resins . . . in a full range of sizes from 3/16" to 2½" O.D.

TULOX
REG. U.S. PAT. OFF

HOLLOW ROD

made from Tenite II

HEXAGONAL • KNURLED • ROUND

NATIONAL DISTRIBUTION—Immediate shipment from warehouse stocks for War Production. Illustrated catalog will be mailed on request of EXTRUDED PLASTICS, Inc., Norwalk, Conn.

In Canada: Sole Licensees, **DUPLATE CANADA, LTD. Plastic Division, Oshawa, Ontario**

Export Dept: AMERICAN STEEL EXPORT CO., INC. 347 Madison Avenue, New York, N.Y.

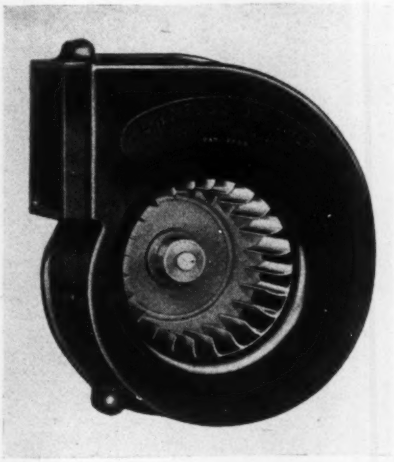
The new arrangement utilizes an airtight room—glass block is used in the instances under construction—in which air pressure is maintained above normal. Air is drawn into this room through ceiling grilles by the fan in the equipment room of the wash and locker building; it is, of course, heated in winter.

The only exit provided for the air is through louvers in the bottoms of all lockers, which are wood construction. Forced through these louvers by the pressure, the air is sucked up through the full interior height of the lockers into plenum chambers set on the locker tops. From here it is vented to the outside.

This device provides a constant stream of air through the dampened clothes from the bottom to the top of the lockers, assuring both a quick and thorough drying. Despite its simplicity of concept, it combines the advantages of conserving metal, time, and privacy.

Blower of Noncritical Material

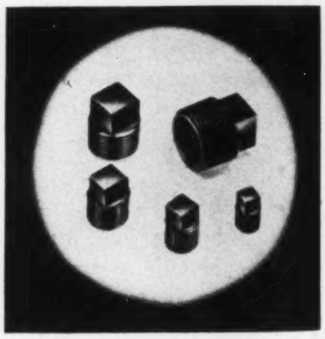
No. 2441—Illustrated is a new blower (housing and turbo type wheel) which has been developed to fulfill a need for a compact, light weight, efficient blower made from noncritical materials, says the manufacturer. Molded in one piece of high impact plastic, this blower has a motor plate which adapts itself to various mounting methods and simplifies installation.



For various recommended motor horsepowers from 1/25 to ½, cfm capacity ranges from 100 to 340 cfm for various static pressures.—L-R Mfg. Co., Blower Division, Torrington, Conn.

Plastic Pipe Seal Plugs

No. 2442—Plastic pipe seal plugs provide protection for threads of units in storage or in transit, and are being furnished in five sizes—⅜, ½, ⅝, ¾, and 1 in.—with other sizes available upon application.

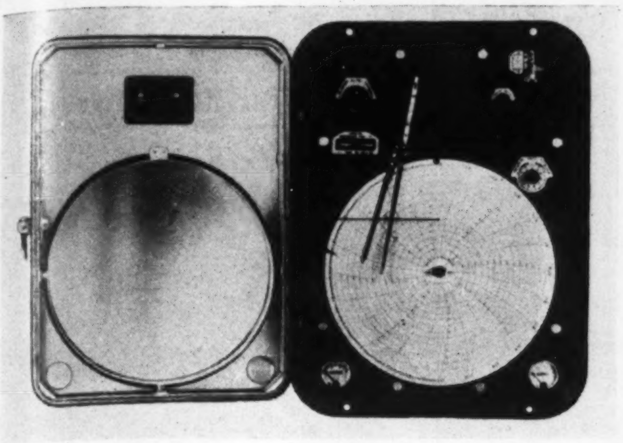


According to the manufacturer, these light, durable, and noncorrosive plastic seals replace critical materials heretofore used and effectively protect threads against damage from moisture, dirt, weathering, rust, and corrosion.—American Molded Products Co., 1644 N. Honore St., Chicago, Ill.

Air Operated Controller

No. 2443—A new air operated automatic control instrument, known as the convertible free vane controller, has been announced. The instrument is made for automatically controlling temperature (up to 3600 F), flow, liquid level, pressure, draft, humidity, pH value, and time program.

This controller operates on the same basic free vane principle as that used in previous models offered by the company. A number of design refinements have been incorporated, which simplify the instrument and make it more convenient to service. The new instrument is also designed



so that the user can convert from one type of control system to another.

It is offered in the following types: "Monoset" (on and off), "Ampliset" (throttling), preset, reset, and "Magniset."

The adjustments for fitting the controller to the requirements of the process are on a dial board above the chart.—The Bristol Co., P. O. Box 1790, Waterbury, Conn.

New Noncritical Plastic From Redwoods

No. 2444—A new, noncritical phenolic type thermoplastic, chemically perfected from the phlobaphanic structures of the redwoods, is now available for both war and civilian production of countless items. Its development represents another step in the conservation of forest products through the economic utilization of logging and mill waste, says the manufacturer.

The new redwood plastic embodies in one composite form both resin and filler employed in the molding of an endless variety of products. It is readily adaptable to either compression molding or the standard equipment of hard rubber plants. When special properties are desired it can be mixed with other resins and plasticizers with control of the formulation ingredients.

Credit for the discovery of this new plastic is shared mutually by The Pacific Lumber Co., 100 Bush St., San Francisco, the Institute of Paper Chemistry, Appleton, Wis., and the Sheller Mfg. Corp., Portland, Ind.

What More Can You Want?

DIRECTHERM

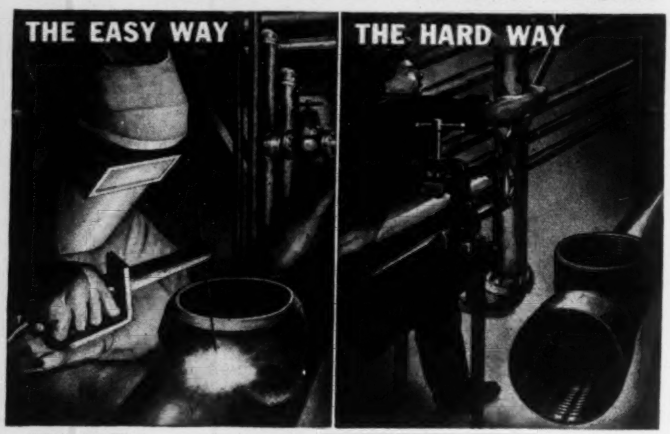
UNIT HEATERS STOKER-FIRED

Low-Cost Heat
+ Quick Installation
+ Even Temperature
+ Metal Conservation
+ No Maintenance
= DIRECTHERM UNIT HEATERS

For coal, gas, and oil. Made in 6 sizes (300,000-1,700,000 Btu.)

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. · ST. LOUIS, MO.

How W-T's* Speed Up Piping Installations for War Production



With W-T's* you simply select the position of the outlet on the main pipe and weld the fitting into place, either before or after erection of the main line. The hole is usually cut in the main pipe with the torch after the fitting is installed.

Old-fashioned methods of cutting, forming and fitting the main pipe for installation of a tee are eliminated with W-T's*—saving time and money. W-T's* provide a simple, fast, economical way to make right-angle, welded branch pipe outlets.

ADVANTAGES OF W-T's*

Eliminate templets and preliminary layouts.

Eliminate cutting, forming and fitting of main line.

Provide leakproof joints of full pipe strength.

Improve flow conditions—reduce turbulence and friction.

Interior of outlet open for inspection after installation.

Eliminate need for extra supports, braces at line of junction.

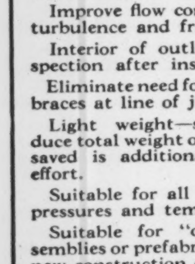
Light weight—save metal—reduce total weight of system. Metal saved is additional help to war effort.

Suitable for all commonly used pressures and temperatures.

Suitable for "on-the-job" assemblies or prefabricated systems—new construction or maintenance.

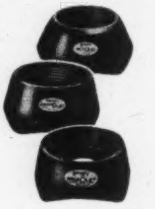
Elimination of exterior obstructions makes neater, more workmanlike installation, permits easier covering with insulation.

Installed by electric-arc or oxy-acetylene method by any welder of average ability.



Write for this 16 page bulletin giving complete details of all their advantages. Ask for Bulletin WT-31.

3 Types Meet Every Need



Beveled outlet of WELDOLETS permits branch pipe to be attached with plain, circumferential, butt weld.

Threaded outlet of THREDOLETS permits branch pipe to be screwed into outlet of fitting.

Outlet of SOCKET-END WELDOLET is bored to accept standard outside pipe diameters. Junction is completed with weld around top of fitting.

All of the fittings give you all of the advantages shown. They are available for all standard pipe sizes up to 24".

*WeldOlets-ThredOlets

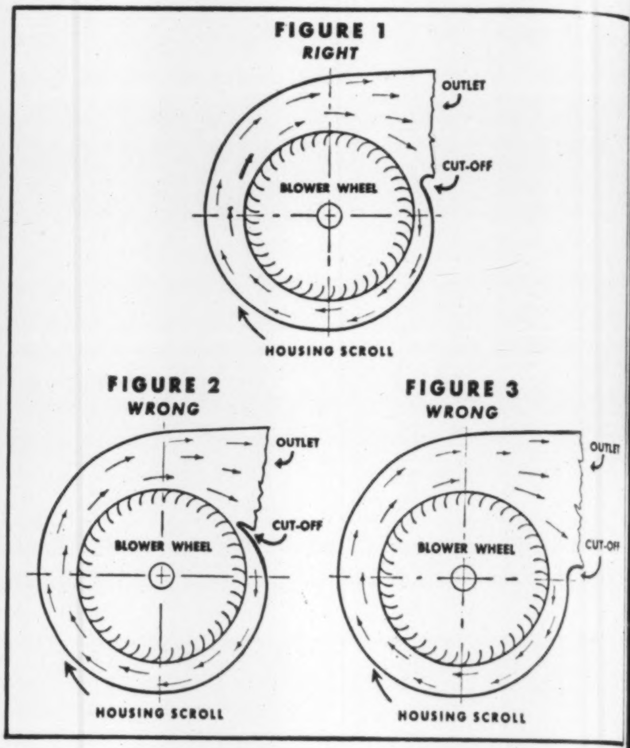
Forged Fittings Division

BONNEY FORGE & TOOL WORKS, Allentown, Pa.

WELDOLETS·
TRADE MARKS REG. U. S. PAT. OFF.
THREDOLETS
Welded Outlets for Every Piping System

Tips for Designing Air Impelling Units

No. 4 of a series



The Blower Wheel Housing Cut-Off

THE FUNCTION of the cut-off is to divert the air stream to the housing outlet and to prevent it from being re-circulated through the housing. The shape of the cut-off, the distance it projects into the outlet and its proximity to the blower wheel require careful consideration.

Figure 1. A correctly designed cut-off. Properly rounded and properly spaced in relation to the wheel and housing outlet.

Figure 2. Wrong. Shows too sharp a cut-off, too close to the wheel. This will produce excessive noise.

Figure 3. Wrong. Cut-off barely projects into the outlet. Air flows freely, but decreased pressure tends to create pulsations in the air stream.

A correctly designed cut-off is but one of a number of important factors that will affect the performance of a blower wheel.

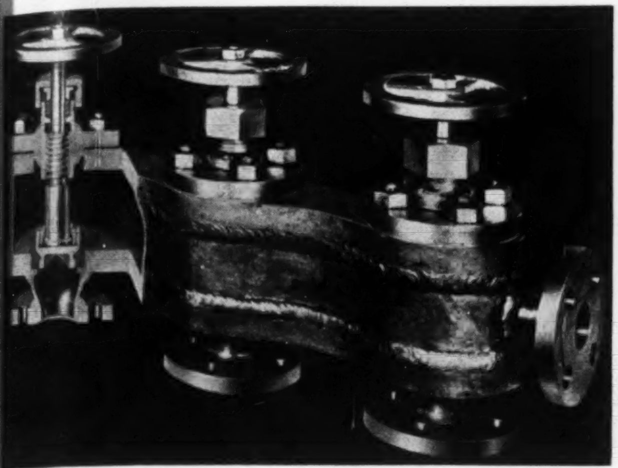
By consulting the Torrington Research Laboratory, preferably during the early design stages of products using air impellers, costly changes and delays may be prevented. This consulting service incurs no obligation.

THE
TORRINGTON
MANUFACTURING CO. TORRINGTON, CONN.

MANUFACTURERS OF AIRISTOCRAT QUIET PROPELLER FAN BLADES AND AIROTOR BLOWER WHEELS

Welded Manifold Valves

No. 2445—Simplification of valve and piping hook-ups is made possible through the use of welded manifold valves, such as those illustrated. Any number of valves of any type in any size, of carbon or stainless steel, chrome iron, nickel, monel, or other alloys can be combined in an integrated unit to meet any requirement, says the manufacturer.



Advantages claimed for welded valves include greater strength with less weight, economy of space, ease of installation, minimum pressure drop, and the elimination of bolts, gaskets, and flanged fittings between individual valves.—Zallea Brothers & Johnson, Taylor and Locust Sts., Wilmington, Del.

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 137. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Air Filter Sizes

No. 4426—28 p. catalog of "Dust-Stop" air filter sizes for forced warm air furnaces and air conditioning units. Designed to help dealers save time in handling sales of these air filters, this catalog lists makes and models of furnaces and units alphabetically by the various manufacturers' names. It also shows the number of filters required for each make and model.—Owens-Corning Fiberglas Corp., Nicholas Bldg., Toledo, Ohio.

Blower Wheels

No. 4427—64 p. catalog containing within one cover complete information on all of the manufacturer's lines of blower wheels. Performance ratings of all the wheels have been rechecked, specifications and performances for many new wheels have been added, and the information is assembled for easy reference.—Torrington Mfg. Co., 70 Franklin St., Torrington, Conn.

Contactors for Resistance Welding

No. 4428—8 p. bulletin (GEA-3058B) describing ignitron contactors for fast and accurate power switching of a-c resistance welding machines, illustrating three standard electronic contactors.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Controllers for Temperature and Pressure

No. 4429—40 p. catalog (1200) of "Tag" indicating and recording controllers for temperature and pressure with

BARBER-COLMAN

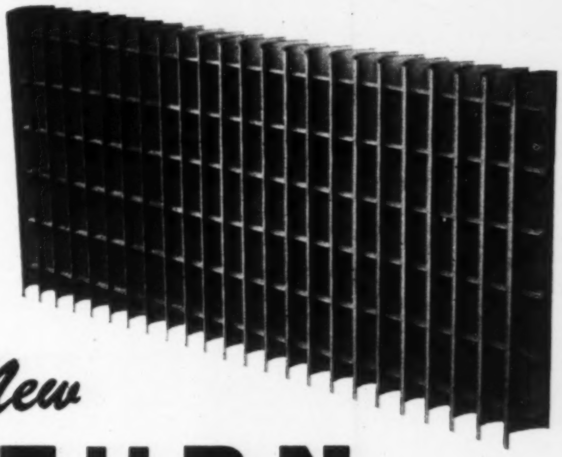
GRILLES & REGISTERS
AIR DIFFUSERS

ENGINEERED
UNI-FLO
GRILLES AND REGISTERS
AIR DISTRIBUTION

AUTOMATIC
CONTROLS

First Again!...

NEW TURNING VANE IS THE BEST NOW AVAILABLE COMMERCIALLY!



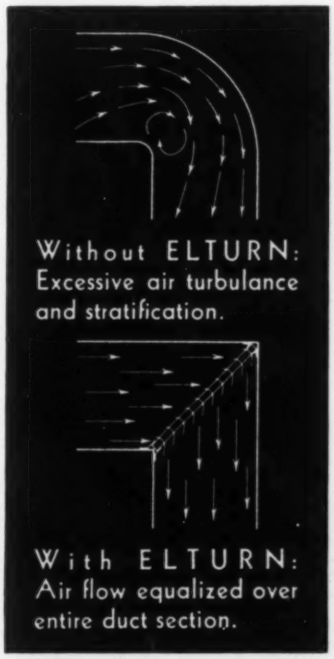
The *New*

ELTURN

Aerodynamically Correct!

85% REDUCTION OF LOSSES...

The new ELTURN effects a substantial reduction in elbow pressure losses in any air distribution system that employs right angle turns, reducing by as much as 85% the losses caused by eddies, reverse air flow, and low pressure areas.



Without ELTURN: Excessive air turbulance and stratification.

With ELTURN: Air flow equalized over entire duct section.

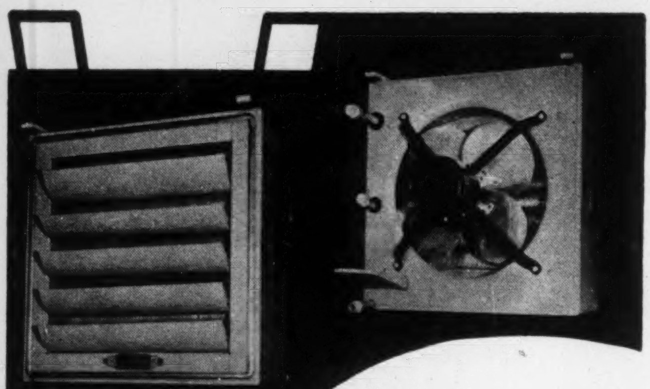
CORRECT AERODYNAMIC DESIGN

The turning vanes were scientifically designed on the basis of best modern aerodynamic principles to obtain these outstanding improvements in performance. The New ELTURN has been thoroughly tested and proved, both in the laboratory and in actual service.

WIDE SPACING POSITIVE INTERLOCKING

The large free area of the New ELTURN precludes the possibility of clogging due to lint and dust. Distinctive construction make a strong and positively interlocked assembly. Write for sizes and other data.

BARBER-COLMAN COMPANY 1228 ROCK STREE
ROCKFORD, ILLINOI



KRAMER

Victory

COOLMASTER

NEW DESIGN FOR

QUICK DELIVERY

An all steel hot galvanized coil is used in the Victory Model Coolmaster. This line of units is designed to comply with the latest government limitations on critical materials. The number of models has been reduced to facilitate quick delivery.

OUTSTANDING FEATURES

Accurately rated. All ratings based on tests made in accordance with accepted standards and are guaranteed.

All steel spiral fin coil, hot galvanized after fabrication.

No welded or soldered return bends.

Can be used with Freon, Methyl, Sulphur, Ammonia, or Brine. Please specify if ammonia or brine will be used.

Heat interchanger is furnished.

One man suspension brackets for easier mounting.

Unusually pleasing in appearance. Finished in chrome gray shade of crackle; baked on a bonderized (rustproofed) base.

Silent, carefully balanced fans, direct connected to totally enclosed motors specially built for fan duty and long life.

Send for Bulletin R-143

KRAMER TRENTON CO.

Trenton, N.J.

comprehensive information on three types—on-off, throttling, and automatic reset. The many illustrations not only show how these pressure spring controllers operate, but include a number of actual installation photographs telling the story of what these controllers are doing in industry.—C. J. Tagliabue Mfg. Co., 540 Park Ave., Brooklyn, N. Y.

Coolant Coolers

No. 4430—4 p. bulletin (R-443) on coolant coolers of the shell and fin tube type, consisting of a spiral finned cooling coil inserted into a steel shell. These units are designed for use with water, brine, or direct expansion refrigerant, and they can be furnished with brackets for floor, wall, or ceiling mounting. Capacity tables and information on dimensions and fittings are included.—Kramer Trenton Co., 626 Brunswick Ave., Trenton, N. J.

Diesel Engines

No. 4431—12 p. bulletin (S-500-B36B) on direct injection, totally enclosed, vertical, four cycle diesel engines, with information on features, specifications, and auxiliary equipment, including pumps, meters, evaporative coolers, starting air compressors and v belt drives. Useful application data and rating and dimension information are appended. —Worthington Pump & Machinery Corp., Harrison, N. J.

Electrical Contacts

No. 4432—36 p. catalog (152) on electrical contacts, discussing the design, manufacture, and application of electrical contacts of silver, platinum, tungsten, molybdenum, and a variety of other metals and alloys. Covering types of contacts, their physical size and shape, and the particular application to which each metal and alloy is best suited, this catalog is planned to provide the design and production engineer a complete story on these devices.—Callite Tungsten Corp., 544-39th St., Union City, N. J.

Electrical Tools

No. 4433—20 p. pocket size booklet (JE-199) explaining how to get maximum service from portable electric tools, containing complete but brief instructions on the proper operation and care of various types. Special attention is given to maintenance of the motor, cable, switch, and brushes.—Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.

Evaporative Condensers and Coolers

No. 4434—8 p. booklet describing new line of evaporative condensers and evaporative coolers, offering general application information with regard to wartime uses of this equipment, illustrating the features, and summarizing the specifications.—General Electric Co., Air Conditioning and Commercial Refrigeration Dept., 5 Lawrence St., Bloomfield, N. J.

Expansion Bolts and Screw Anchors

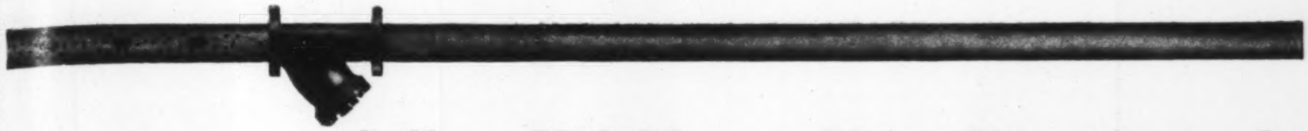
No. 4435—Ready reference wall chart covering expansion bolts and screw anchors, illustrating the several types and giving plug and drill numbers, screw and bolt sizes, information on holding power, and other such data.—Rawlplug Co., Inc., 98 Lafayette St., New York, N. Y.

Fiber Pipe

No. 4436—16 p. bulletin describing "Orangeburg" fiber pipe for nonpressure uses, explaining how it is made, giving data on general properties and characteristics, installation, connections, bends and elbows, laying instructions, etc. —Fibre Conduit Co., 292 Madison Ave., New York, N. Y.

Fire Extinguishing Equipment

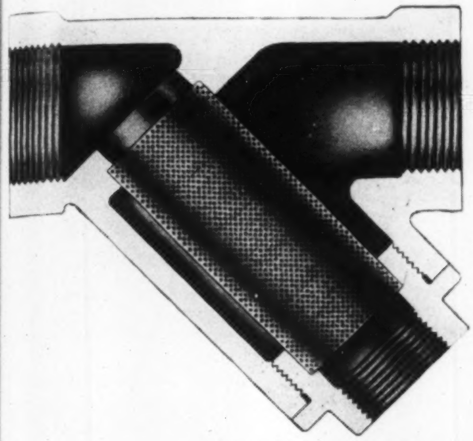
No. 4437—Two charts showing the operating characteristics of first aid hand fire extinguishers and wheeled engine extinguishers, tabulating the several types and summarizing



Call on K & M . . . *to Keep Your Control Equipment at Peak Efficiency!*

Our entire manufacturing output has gone to war . . . but 65 years of know-how is here to help you. If you have a pressure or fluid control problem—*any kind* of an installation, operating or maintenance problem—*call on K. & M.* Our new VALVE PROBLEMS CLINIC is a clearing house of information established to help keep your business going. There is no charge for this service. You needn't be using K. & M. equipment. But you have a job to do . . . and we want to *help* you do it, with specific, informative, resultful assistance.

K. & M. STRAINERS—"Y" and Basket Types for use on steam, water, gas, air, oil and other fluids. Note the oversized strained basket area to assure minimum pressure loss. Baskets are easily accessible for cleaning. These features are typical of the simplicity and efficiency of K. & M. design.



KM KIELEY MUELLER ESTABLISHED 1879

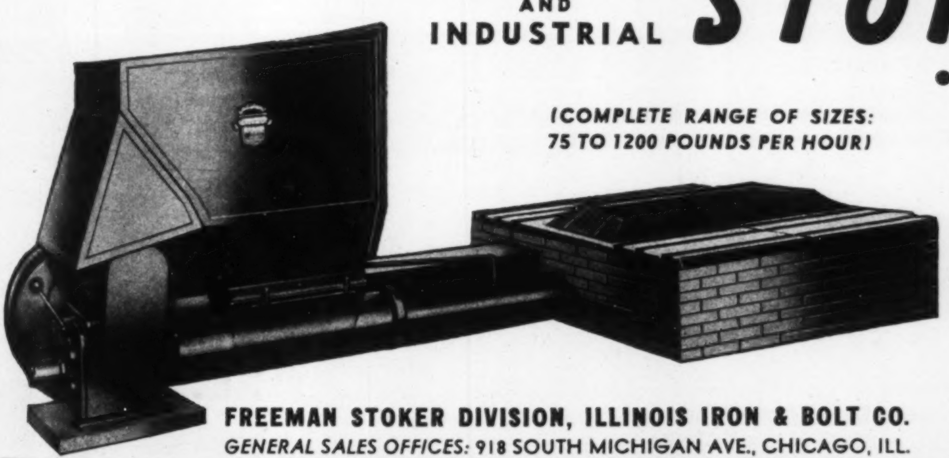
Kieley & Mueller
ENGINEERED PRESSURE & FLUID CONTROL SPECIALTIES
NORTH BERGEN, NEW JERSEY
Representatives in all Principal Cities

DO SOMETHING ABOUT OIL CONVERSION

with FREEMAN

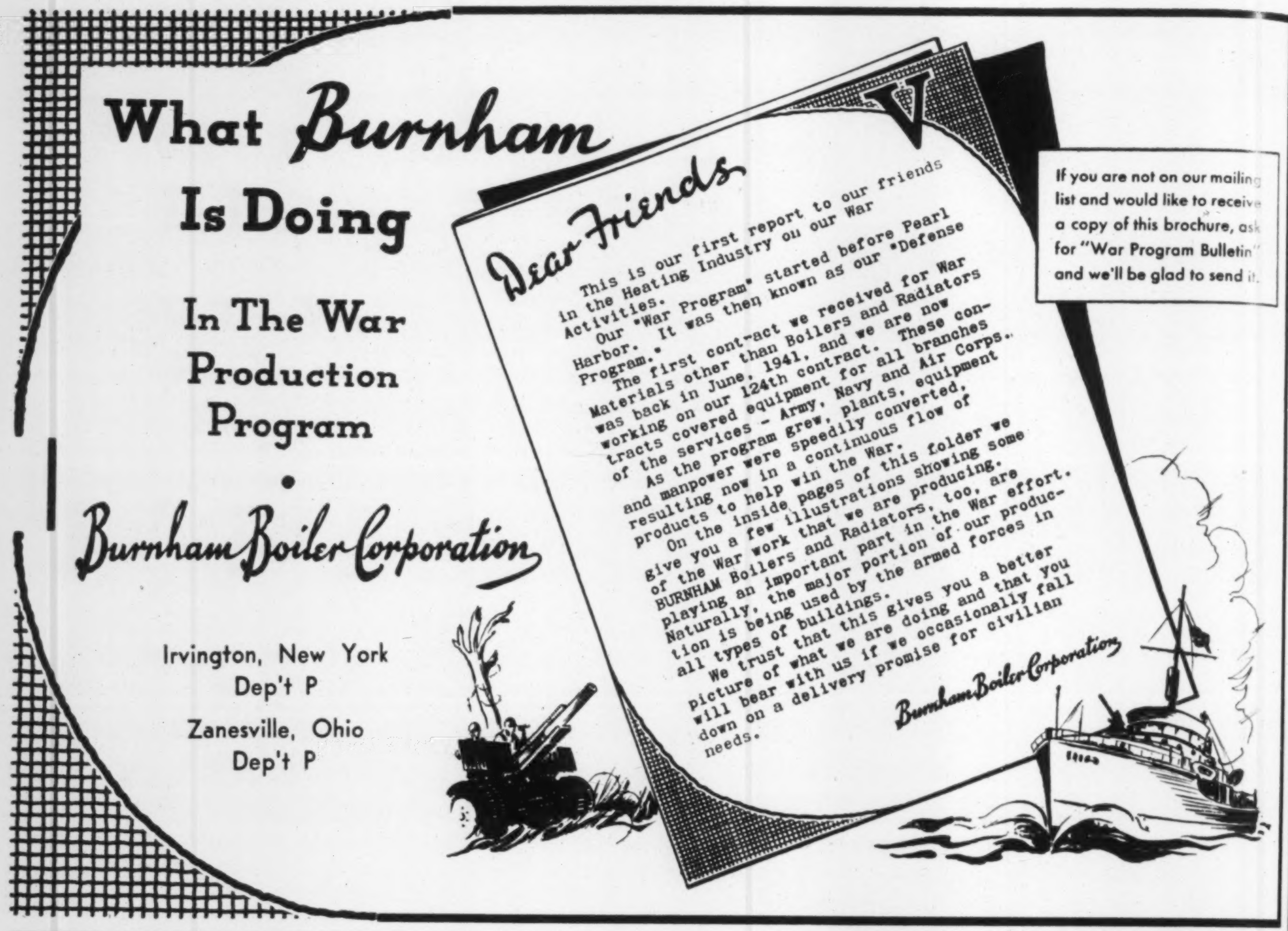
COMMERCIAL AND INDUSTRIAL **STOKERS**

(COMPLETE RANGE OF SIZES: 75 TO 1200 POUNDS PER HOUR)



- Most commercial and industrial oil burners must now be converted to coal! You can make big money . . . and render vitally important service . . . by speeding this change-over with Freeman Stokers. Freeman is first choice of America's foremost heating engineers . . . has a time-proved record of dependability and long life . . . is manufactured by a pioneer leader in the stoker industry, rated AAA1, established 1864. Write immediately for details on your territory!

FREEMAN STOKER DIVISION, ILLINOIS IRON & BOLT CO.
GENERAL SALES OFFICES: 918 SOUTH MICHIGAN AVE., CHICAGO, ILL.



What *Burnham* Is Doing

In The War Production Program

•

Burnham Boiler Corporation

Irvington, New York
Dep't P

Zanesville, Ohio
Dep't P

Dear Friends

This is our first report to our friends in the Heating Industry ou our War Activities.

Our "War Program" started before Pearl Harbor. It was then known as our "Defense Program."

The first cont-act we received for War Materials other than Boilers and Radiators was back in June, 1941, and we are now working on our 124th contract. These contracts covered equipment for all branches of the services - Army, Navy and Air Corps.

As the program grew, plants, equipment and manpower were speedily converted, resulting now in a continuous flow of products to help win the War.

On the inside pages of this folder we give you a few illustrations showing some of the War work that we are producing. BURNHAM Boilers and Radiators, too, are playing an important part in the War effort. Naturally, the major portion of our production is being used by the armed forces in all types of buildings.

We trust that this gives you a better picture of what we are doing and that you will bear with us if we occasionally fall down on a delivery promise for civilian needs.

Burnham Boiler Corporation

If you are not on our mailing list and would like to receive a copy of this brochure, ask for "War Program Bulletin" and we'll be glad to send it.

The SILVER SIDE *of the* FUEL OIL "CLOUD"

Do you realize that every newspaper and every radio station in America has been "selling" oil burners during the past winter?

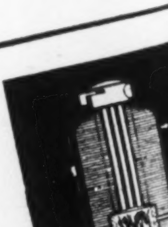
Yes, *selling* them! Not directly, of course. Nor intentionally. Yet publicising them as no private advertising campaign could hope to do.

Every American who can read, now knows how regretfully the owners of oil burners converted to coal. And now knows that oil burners are a *major* factor in heating the nation's homes, offices and factories. Two-inch headlines and spot-news broadcasts have told the story as it never has been told before.

Already it is apparent that the public has a new interest and a new appreciation of oil burners. The Gallup Poll reports: 7% of the people questioned in a recent poll said their first major purchase after the war would be an oil burner.

It is our belief that untold opportunities for new usefulness are being opened up for the Oil Burner Industry. Every ounce of energy which we of the S. T. Johnson Co. can spare from building Aqulux Water Heaters for the needs of Uncle Sam, is being used to plan for a still bigger job in happier years ahead. S. T. Johnson Co., 941 Arlington Avenue, Oakland, California, and 401 No. Broad Street, Philadelphia, Pa.

AQULUX
Heavy Duty
WATER HEATERS



Though the Army and Navy are taking most of our production of these high-efficiency heaters, we may be able to help you meet hot water problems for War Industry or Military installations. Aqulux heaters are built with capacities up to 540 gal. per hr. and in 4 basic types. We will gladly send detailed information.

S. T. JOHNSON CO.

40 years of engineering and building fine Oil Burning Equipment

their suitability as applied to class A, B, and C fires, as well as other kinds of fires. Complete data on extinguishers and engine characteristics, methods of operation, capacity, range of stream, etc., are included. Also, a booklet on maintenance of first aid fire fighting equipment with information on inspection, upkeep, charging, discharging, recharging, etc.—American-LaFrance-Foamite Corp., 100 E. LaFrance St., Elmira, N. Y.

Gaskets

No. 4438—First of a series of technical bulletins describing the manufacturer's research laboratory and methods of testing used in determining factors in gasket engineering. Succeeding issues are to treat the study of each gasket type individually.—Goetze Gasket and Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J.

Heat Controls

No. 4439—Folder listing a few wartime applications of the manufacturer's temperature and safety limit switches, and giving brief specifications for four different instruments. Wartime industries for which these controls are used include aircraft, aluminum, explosives, and synthetic rubber manufacturing; oil refining; shell loading plants; naval and marine uses; etc.—Burling Instrument Co., 253 Springfield Ave., Newark, N. J.

High Pressure Piping

No. 4440—8 p. bulletin giving a comparison of code requirements for welding, preheating, and stress relieving of high pressure piping with reference to the ASME boiler construction code and the ASA code for pressure piping. Among the topics covered are differences in internal working pressure as specified in the two codes, welding, welding specifications, and the requirements of the two codes regarding scope, backing rings, inspection, preheating, identification, stress relieving, and testing.—Midwest Piping & Supply Co., Inc., Second and Barry St., St. Louis, Mo.

Instruments

No. 4441—Issue of Wheelco Comments (vol. 2, no. 5) including a short article on methods of prolonging instrument life through centralizing responsibility, proper location, eliminating vibration, protecting from dirt and corrosion hazards, avoidance of excessive moisture and temperature, etc.—Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill.

Pump Shafts and Rods

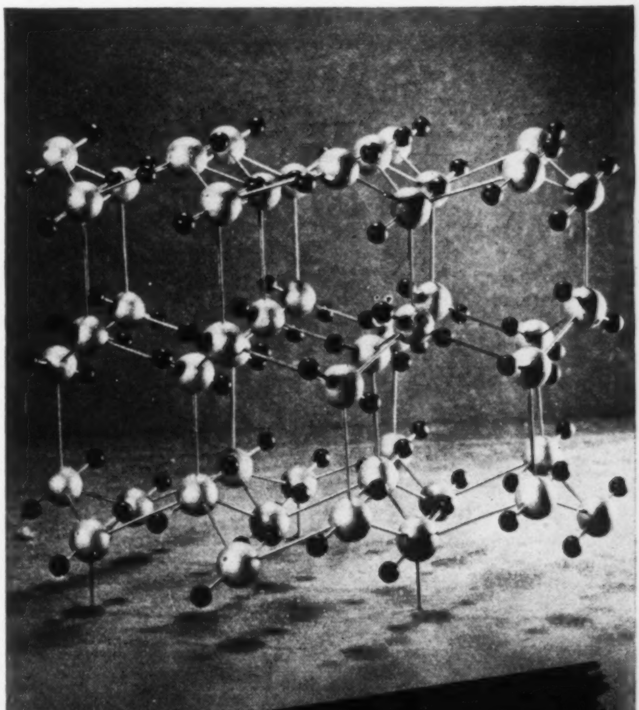
No. 4442—8 p. booklet on reconditioning worn pump shafts and rods, describing four different methods for renewing worn metal parts. The booklet explains and illustrates the step by step procedures for reconditioning the shaft: (1) by machining and refinishing the worn section; (2) by building up and refinishing the section by welding; (3) by metal spraying; and (4) by heavy and hard electrodeposition.—International Nickel Co., 67 Wall St., New York, N. Y.

Punch Presses with Gage Tables

No. 4443—12 p. bulletin (92) on turret punch presses with gage tables, discussing applications in short run piercing practice, short run piercing job factors, and describing the turret and the various types of gage tables, as well as presenting typical data and specification sheets.—Wiedemann Machine Co., 1815 Sedgley Ave., Philadelphia, Pa.

Shop Equipment for War Plants

No. 4444—Circular illustrating and describing standard shop equipment available for war plants, including variable speed transmissions, conveyors and feeders, chain and electric hoists, etc.—Standard Transmission Equipment Co., Suite 330, 416 W. 8th St., Los Angeles, Calif.



INSULATION PROBLEM...

THE STRUCTURE shown above represents one of the fundamental insulation problems in refrigeration. It is, in effect, the "catalyst" in which vermin and mold breed . . . it favors the activities of termites . . . and it is the basic cause of rot. It is a physicist's representation of molecules of water . . . in crystal form, as ice. The small balls represent hydrogen atoms, the large balls oxygen atoms.

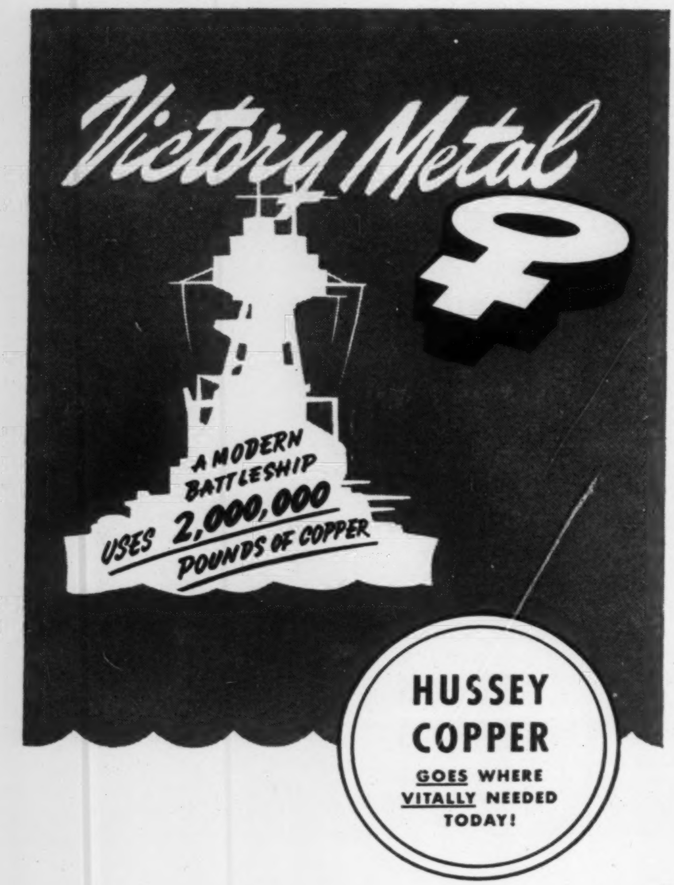
Water, or moisture, causes no insulation problems, however, when J-M Rock Cork is used for low-temperature insulation. For J-M Rock Cork is sealed against moisture . . . is immune to termites, vermin, mold. It can't rot, does not absorb odors.

Rock Cork is essentially mineral wool, one of 4 basic materials from which all Johns-Manville products stem: Asbestos, asphalt, diatomaceous earth and mineral wool.

Today, the prime task of Johns-Manville is to make these products as fast and as well as possible for war needs until Victory is won. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM

Johns-Manville
ROCK CORK


Victory Metal
A MODERN BATTLESHIP USES 2,000,000 POUNDS OF COPPER
HUSSEY COPPER GOES WHERE VITALLY NEEDED TODAY!

America's copper supply will determine the number of fighting vessels and other major war vehicles we can produce to defeat the Axis.

Today,—every available pound of HUSSEY COPPER is going into direct military orders —or essential war industry uses.

HUSSEY

C. G. HUSSEY AND COMPANY
(Division of Copper Range Co.)
Rolling Mills and General Offices: Pittsburgh, Pa.
Warehouses in Principal Cities

REZNOR
REZNOR
UNIT HEATERS HELP KEEP JIM OFF THE ABSENTEE LIST . . .

During Winter and Summer

GREATER EMPLOYMENT plus crowded plant conditions call for wider distribution of heat as well as better air circulation. Easily installed gas fired Reznor Unit Heaters meet these emergency demands. Due to the special design of Reznor Heat Exchanger Tubes, more warm air is moved from Reznor Heaters in winter and greater air circulation is provided during hot summer days. Men on the war production line work in comfort—hence, less fatigue, more efficiency, fewer days off for illness, and greater production result. This easy-to-install equipment SAVES 89% in vital materials. Write today.

REZNOR MANUFACTURING CO.
305 JAMES ST. MERCER, PENNA.

"GAS HEATERS EXCLUSIVELY SINCE 1888"

Soldering Flux

No. 4445—Small folder describing "Lloyd's No. 6" soldering fluid, a flux developed for use with low tin content solders.—Lloyd S. Johnson Co., 2241 Indiana Ave., Chicago, Ill.

Steam Generation

No. 4446—36 p. booklet, entitled Dividends From Your Power Plant, published as a service to engineers, executives, and owners of establishments in which steam is generated for power, heating, or processing. The booklet discusses subjects such as the dollars and cents importance of boiler efficiency, the relation between steam costs and profits, natural versus mechanical draft, carbon dioxide and carbon monoxide, excess air, and factors that govern labor costs in the boiler room. The text is pointed up with examples, tables, and sketches to make each topic clear.—Preferred Utilities Co., Inc., 33 W. 60th St., New York, N. Y.

Steam Traps

No. 4447—4 p. folder describing improved corliss valve "Ace" steam trap, stressing simplicity and efficiency of the valve mechanism. The valve functions by rotating within a cylinder provided with inlet and discharge ports, and it is claimed that the valve never draws away from its seat, thus preventing wear on either the seat or the face of the valve. Size and capacity tables are included.—W. B. Connor Engineering Corp., 114 E. 32nd St., New York, N. Y.

Synthetic Rubber

No. 4448—8 p. catalog section devoted to the properties of "Ameripol D," an oil and heat resisting synthetic rubber used in many specialized industrial applications. Among the subjects covered are resistance to various substances, hardness, tensile strength, elongation, weight, color, odor and taste, elasticity and permanent set, resistance to tear, abrasion, flexing, etc.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Unit Heaters

No. 4449—Catalog sheet describing "Grid" cast iron unit heaters which were introduced last year as a substitute for aluminum heating sections to cooperate with the war effort.—D. J. Murray Mfg. Co., Wausau, Wis.

V Belt Drives

No. 4450—12 p. issue of Texrope Topics (vol. 13, no. 1) devoted to rubber conservation by using larger sheaves to increase capacity of belts, by permitting the use of fewer belts. The program consists of two parts, the use of shorter center distances and the use of larger sheaves, and applies only to new drives bought and installed during 1943 and not the re-engineering of present drives. A table summarizes the spectacular rubber savings contemplated by the plan.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Welding Cast Iron

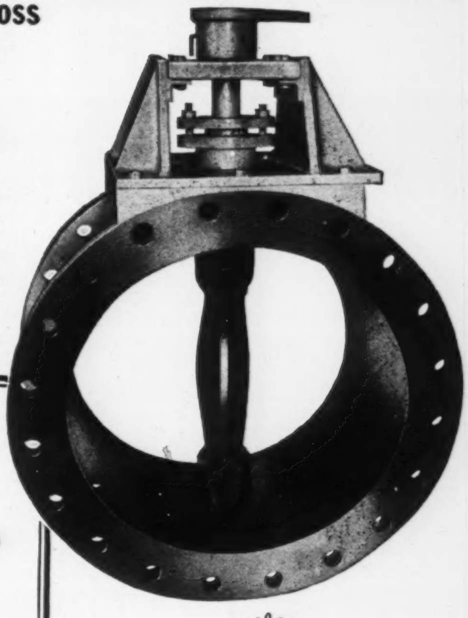
No. 4451—4 p. bulletin describing an improved method for welding cast iron recommended by the manufacturer for salvaging defective castings and for essential maintenance.—Eutectic Welding Alloys Co., 40 Worth St., New York, N. Y.

Welding Fittings in Marine Piping

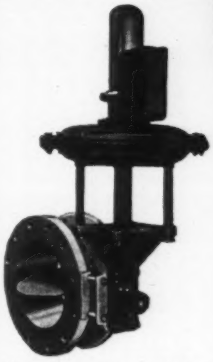
No. 4452—4 p. bulletin giving comparative data and drawings on a typical auxiliary exhaust section for marine piping designed with welding fittings versus cast fittings and flanged construction.—Tube Turns, Inc., 238 E. Broadway, Louisville, Ky.

PARTICULARLY
well adapted for
WATER LINES

Low Pressure Loss When Open



Standard 24-inch 125 lb. iron valve with ball crank arm for connection to extended reach rod. Sleeve bearing lubricated stuffing box with cage. When the vane is fully open, flow conditions are similar to those produced in two Venturi Tubes.



Air diaphragm motor for automatic operation—15 pounds pressure.

R-S QUALITY PRODUCTS SINCE 1908

15 to 900 psi

The pressure loss in a wide open R-S Butterfly Valve is less than in most conventional types of wedge gates. In fact, the streamlined vane is a Venturi maker and is practically self-cleaning. Any member of the R-S Butterfly Valve line will sting the maintenance bill every time.

These valves are accurately machined and are either manually or automatically controlled. The beveled vane seats at an angle against the valve body. There is a size and type for practically any service condition.

SUBSTITUTE METALS—R-S has developed pressure iron castings for resistance against heat, abrasion and corrosion. They replace vital victory production metals and are considerably lower in price. For instance, R-S "A" Metal, a tough dense metal of high endurance, is used in applications where hard wear and severe stresses are encountered. Has a tensile up to 50,000 psi and is readily machinable. Write for detailed information and the R-S Butterfly Valve Catalog.

VALVE DIVISION
R-S PRODUCTS CORPORATION
132 Berkley Street Philadelphia, Penna.

R-S *Streamlined* BUTTERFLY VALVES

WECO-N.G.E. Series F600 GAS BURNERS

These burners are available for ratings from 50,000 to 10,000,000 B. t. u. output, for use in heating boilers, power boilers—in any metal firebox or sectional boiler.

Featuring flexibility to meet various firebox shapes and sizes at various gas pressures, and low draft loss. Full automatic controls that operate properly can be easily applied.

GUARANTEED VIBRATIONLESS

This burner operates on straight natural gas and mixed gas to 800 B.t.u. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

THE WEBSTER ENGINEERING CO.

TULSA — DIVISION OF — **OKLAHOMA**

Surface Combustion . . . . Toledo, Ohio

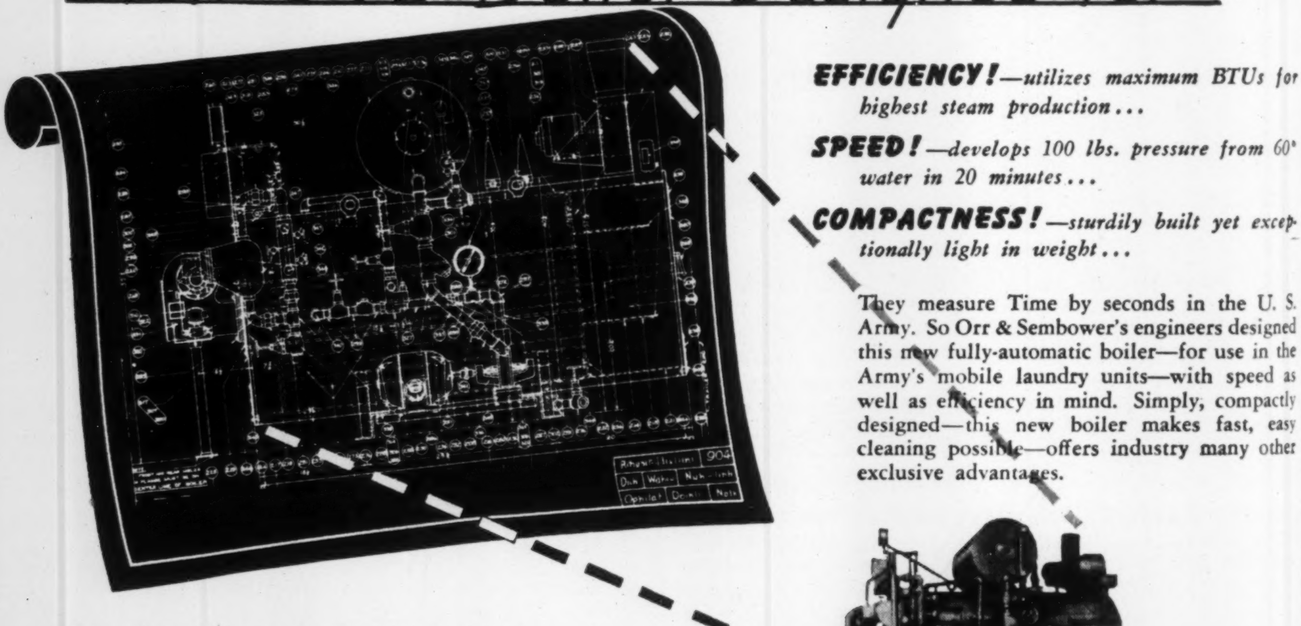
New O&S Boiler Designed for

EFFICIENCY!*—utilizes maximum BTUs for highest steam production...*

SPEED!*—develops 100 lbs. pressure from 60° water in 20 minutes...*

COMPACTNESS!*—sturdily built yet exceptionally light in weight...*

They measure Time by seconds in the U. S. Army. So Orr & Sembower's engineers designed this new fully-automatic boiler—for use in the Army's mobile laundry units—with speed as well as efficiency in mind. Simply, compactly designed—this new boiler makes fast, easy cleaning possible—offers industry many other exclusive advantages.



Although developed expressly for mobile use in the Army's laundry units, this revolutionary O & S boiler promises wide application in your industry when Victory makes O & S boilers again available for all purposes.

ORR & SEMBOWER INC. O&S **Builders of Better Boilers Since 1885**

READING • PENNSYLVANIA

Useful Information

Pricing Used Air Conditioning Systems for Use in War Industries

Methods of pricing used refrigerating and air conditioning equipment of less than 25 hp, which is sold as part of the War Production Board Program to convert such equipment for use in war industries, were announced April 26 by the Office of Price Administration.

The new action was embodied in amendment No. 162 to supplementary regulation No. 14 of the general maximum price regulation, which, effective May 1, 1943, provides that users of the smaller type equipment may resell it to the manufacturers on a basis of total installed costs less 5 per cent yearly depreciation.

Manufacturers may resell the smaller equipment on a reconditioned and guaranteed basis to a new user designated by the War Production Board at a price reflecting total cost of equipment to the manufacturer including dismantling, inspection, and shipping costs to the plant in addition to the costs for reconditioning, reshipment to the purchaser, and installation. To these costs, the manufacturer may also add out-of-pocket expenses incurred in the sale, plus reasonable charges for engineering and profit, not upon the cost to the manufacturer but in the light of the manufacturer's risk and responsibility. However, manufacturers' prices must be approved by OPA.

The present amendment also contains the same provisions with respect to the sales of the smaller type equipment when made by a state or its political subdivisions as were contained for large scale equipment in the amendment to regulation No. 136, in which the states are allowed to use an appraised instead of fixed depreciation rate if approved by WPB.

WPB Prohibits Steel Valves of 400 Psi Series

By request of the Valve Manufacturers' Association the following note is being inserted into each copy of the American War Standard, Pressure-Temperature Ratings for Steel Pipe Flanges, Flanged Fittings, and Valves (B16e5-1943), according to Industrial Standardization, which is published by the American Standards Association:

The attention of those using the American War Standard B16e5-1943 is called to the WPB limitation order L-252 dated January 23, 1943. This limitation order prohibits the manufacture, sale, or purchase of valves of the 400 psi series, beginning May 1, 1943, with certain stated exceptions.

New WPB Regulations Affecting Heating, Piping, and Air Conditioning

(*Issued to April 17. Selected from listing compiled especially for Victory Bulletin, issued by the Office of War Information, by field contact branch of the War Production Board.*)

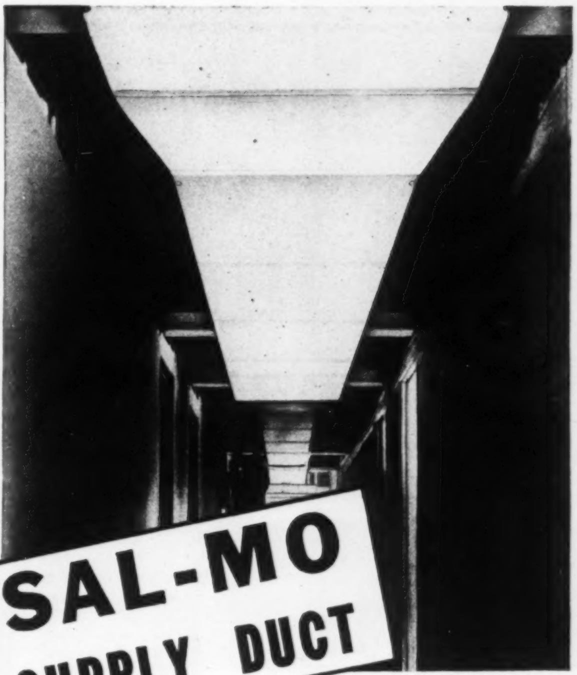
Order L-38, amended. Industrial and commercial refrigeration and air conditioning machinery and equipment. Restricts repair parts deliveries; restricts delivery of other equipment as specified, subject to certain exemptions and "authorized" orders; restricts production by types; requires replaced parts utilization.

Order L-38, amended. Refrigeration and air conditioning machinery equipment. Revises "authorized order" to include those received by 4-6-43 rated A-1-c or better.

Order L-42, II. Plumbing and heating. Revokes the schedule.

Order L-75, 1. Coal stokers. Defines "class A stoker," "grate areas," "coal feeding capacity."

Order L-126, amended. Industrial and commercial refrigeration and air conditioning machinery and equipment. Permits establishment of schedules of required specifications.



SAL-MO
SUPPLY DUCT

Showing a Typical Installation of Sal-Mo Supply Duct in a Defense Housing Project. Metal Was Used Only For Fittings, and Hangers

NON-METALLIC MATERIAL for constructing ducts for Warm Air Heating, Ventilating and Air Conditioning systems. Sal-Mo Supply Duct permits many installations that would otherwise be impossible because of the shortage in metals.

Sal-Mo Supply Duct, because of its low conductivity rate, assures efficient operation in both heating and cooling systems. Friction loss is low because of smooth interior surfaces. Air tight construction prevents heat loss.

Fabrication and packaging at the factory brings labor costs, shipping, trucking and storage expense to a minimum.

PROMPT DELIVERY—Sal-Mo Supply Duct is available in any quantity, in a complete range of sizes for domestic or industrial requirements. Furnished also in flat sheets for fabrication of ducts or for insulation.

APPROVED and LISTED BY UNDERWRITERS' LABORATORIES, INC.

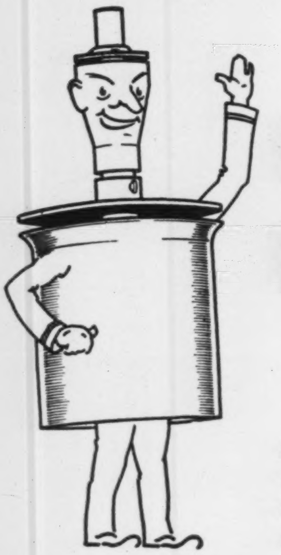
Sal-Mo Supply Duct is Tested For:

Fire Hazard Classification; Inflammability; Fire Retardant Classification; Fire Spread; Moisture Absorption.

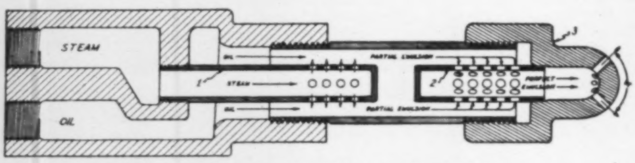
Write For Information Regarding These Tests

SALL MOUNTAIN COMPANY
176 W. Adams St. Dept. F-3 Chicago

JOHN ZINK makes Good OIL BURNERS, Too!



Recent tests on the West Coast resulted in an immediate order for more "MTH" Oil Burners.



1—TANGENTIALLY DRILLED STEAM NOZZLE
2—HOMOGENIZER NIPPLE
3—ALLOY STEEL TIP
4—ROUND OR FLAT FLAME

JOHN ZINK "MTH" OIL BURNER

HEAT PATTERN—The John Zink Series "MTH" Oil Burner, when properly adjusted produces a clear, sharp, transparent blue-white flame under the most adverse conditions—the heat pattern is very similar to a gas burner.

TYPE OF FUEL—Performs equally well with any fuel from gasoline to pitch; in fact, any type of fuel may be used as long as it will flow freely. A change from one type of fuel to another does not upset the burner. Wet steam and slugs of water do not seriously upset operation.

STEAM CONSUMPTION—As low as 0.15 pound per gallon of oil. This consumption is made possible by releasing steam for atomization through thirty-two tangentially drilled steam ports. A whirling motion is imparted to the oil to cause it to flow instantly and evenly through the tip ports.

TURN-DOWN RANGE—Wide turn-down range, requires no delicate adjustments, readily adapted to automatic control. It will turn down to 10% of full capacity without trouble. Capacities of 1,000,000 to 35,000,000 B.t.u. hr. are available.

Write for Details Now!

John Zink Co.
TULSA, OKLAHOMA

New York • Los Angeles • Detroit • San Francisco

Order L-126, schedule I amended. Water drinking coolers. Establishes production specification on types, sizes, capacities, and materials.

Order L-126, schedule II amended. Refrigeration condensing units. Establishes production specifications on types, sizes, and materials.

Order L-126, schedule III amended. Coil or tube assemblies for refrigeration condensers or coolers. Establishes production specifications according to use.

Order L-126, schedule IV. Refrigeration valves, fittings, accessories, and other parts. Establishes production specifications on use of metal.

Order L-126, schedule V. Commercial reachin and walkin (prefabricated sectional) refrigerators. Establishes production specifications on sizes and use of metal.

Order L-126, schedule VI. Refrigerant and service connections. Establishes production specifications for use of metal.

Order L-176, amended. Domestic and commercial electric fans. Restricts manufacture, assembly, and transfer to specified types of orders or as authorized; restricts manufacture of repair or replacement parts.

Order L-217, schedule IX. Tank car heaters and pumping boosters or circulators. Limits production to specified sizes and types; permits repair parts production.

Order L-246. Pumps. Restricts acceptance and delivery of new pumps and repair parts to orders rated AA-5 or better or as specifically authorized; permits specification schedules.

Order L-280, amended. Fans and blowers. Exempts furnace type fans from acceptance restrictions on dealer.

Order L-288. Grey cast iron, malleable iron and brass and bronze pipe fittings; simplification. Restricts manufacture, sale, and delivery to specified types, sizes, and specifications.

Order M-9-c, amended. Copper. Amends list A-2, military exemption list and combined list.

Order M-21, amended. Iron and steel. Changes order to conform and function with CMP.

Order M-21-b-1. General steel warehouses and dealers. Establishes procedure whereby distributors may obtain general steel products from producers and others for delivery to distributor's customers under CMP.

Order M-45, amended. Sheet steel. Eliminates reference to P-76, which is revoked.

Order M-126, amended. Iron and steel conservation. Revises order to eliminate conflict with other orders since issued.

Order P-55, amendment 1. Construction. Revokes necessity of counter-signature on purchase orders by authorized government official.

Order P-55-b. Construction. Authorization for housing construction pursuant to L-41.

Order P-98-b, amended. Production, etc., of petroleum. Assigns AA-1 rating to deliveries of materials other than aluminum for maintenance, repair, operating supplies, subject to certain restrictions.

Order U-1, amended. Electric, gas, water, steam utilities—materials. Amends restrictions on use of extension and application of rating and CMP allotment symbol; amends use restrictions; adds schedule E.

Order U-1-c, amended. Electric, gas, water, and steam utilities—materials. Adds milk sterilizers to permitted connections; amends restrictions on constructions.

Order U-1-d, amended. Electric, gas, water, steam utilities—materials. Requires record of work initiated pursuant to order.

Order U-1-e. Electric, gas, water, steam utilities—materials. Permits water service connections to Victory gardens, subject to certain provisions.

Killing Airborne Bacteria

Triethylene glycol vapor, which will kill airborne bacteria in a matter of seconds, is not toxic to human beings and can be used with complete safety, Dr. Oswald H. Robertson, professor of medicine, University of Chicago, announced last month in a lecture before the Harvey Society of New York, sponsored by the New York Academy of Sciences.

NCREASE YOUR PRESENT REFRIGERATION CAPACITY WITHOUT ADDING COMPRESSORS

PATENTED

● The NIAGARA "No-Frost" Method eliminates the progressive icing of refrigeration coils with the attendant loss of refrigeration. It enables you to refrigerate additional space without adding to compressor load —or to save power in present operation.

In addition, the Niagara DUO-PASS AERO CONDENSER increases refrigeration capacity by reducing head pressures. This has been proved by users' power costs reduced as much as 35% when the use of refrigeration capacity was not increased.

Save power and money, or increase refrigerated space by using these machines. For ample assurance of these benefits write for information on users' experience and for Niagara Bulletins 83, 91 and 95. Dept. HP-53.

NIAGARA BLOWER COMPANY

General Sales Office: 6 E. 45th Street, New York City

37 W. Van Buren St., Chicago
Fourth & Cherry Bldg. Seattle

District Engineers in Principal Cities

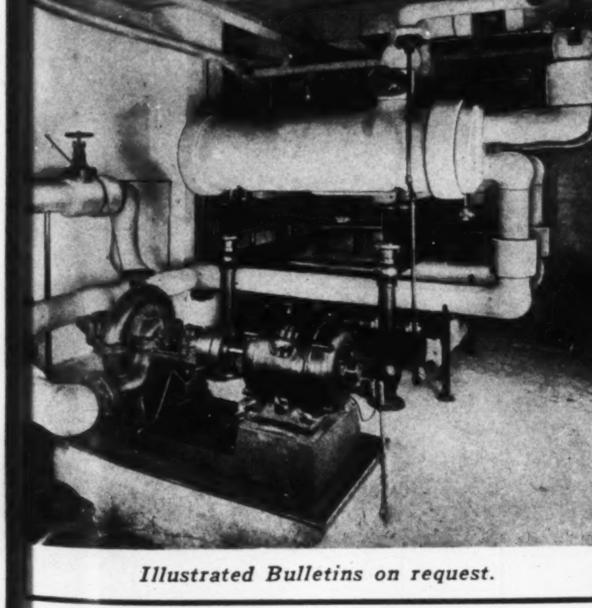
NIAGARA *INDUSTRIAL* **COOLING • HEATING • DRYING**
HUMIDIFYING • AIR ENGINEERING ***EQUIPMENT***

ARCHITECTS ENGINEERS CONTRACTORS

Specify . . . **WHITLOCK CONVERTORS**

For many installations, the forced circulation method of hot water heating has definite advantages, such as (1) ability to carry the heating water for long horizontal distances, (2) ease of exact control, (3) ease of carrying relatively heavy overload.

Whitlock Convertors, designed to fulfill the particular requirement, have been installed in many buildings, including: Dennison Mfg. Co., Marlboro, Mass.; Colt's Patent Firearms Mfg. Co., Hartford, Conn.; United Benefit Life Insurance Co., Omaha, Nebraska; and the Harvard Medical School, Boston, Mass.



Illustrated Bulletins on request.

THE WHITLOCK MANUFACTURING CO.

44 South Street • Elmwood, Hartford, Conn.

DISTRICT OFFICES IN

New York • Chicago • Boston • Philadelphia
Detroit • Richmond

PETRO
REG. U. S. PAT. OFF.

Industrial and Commercial OIL BURNING SYSTEMS

are restricted—"for duration," to orders carrying high preference ratings.

Petro service, parts for necessary maintenance, and engineering consultation and services, are still fully available.

Petro Oil Burning Systems are meeting unprecedented steam demands in war production plants everywhere;

—24 hour operation, far above normal ratings, week after week;

—a "break down" test on a gigantic scale which Petro Equipment is meeting efficiently, economically, reliably, and without breaking down because ample reserve strength and wear has always been built into Petro Systems.

In addition to being proud of such performance, we think it is a good thing for the heating trade to remember against the time when conditions again permit the free selection and installation of normal industrial and commercial firing equipment.

Our complete Industrial Catalog may be consulted in either SWEET'S or DOMESTIC ENGINEERING Catalog Files—or copies will be sent gladly on request.

**OIL IS AMMUNITION
USE IT WISELY**

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD CONNECTICUT

The experiments on toxicity were the final major step in the series relating to Dr. Robertson's discovery that the glycol compounds in imperceptible vapor form, of one part glycol to 200 million parts of air, will sterilize the atmosphere in buildings where humans congregate and under proper conditions destroy the germs of pneumonia, streptococcus infection, influenza, and quite probably the common cold and other airborne infections.

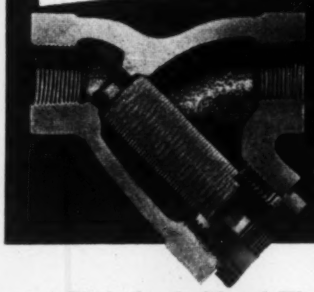
At this concentration, which is the saturation point of triethylene glycol, Dr. Robertson's latest experiments have demonstrated that this chemical has no harmful or apparent effect on the bronchial tract, the kidneys, or the liver, as do some other forms, notably ethylene glycol and diethylene glycol. The use of the vapor introduces no fire hazard, he said.

Dr. Robertson exposed rats to air saturated with the triethylene glycol for six months, and a colony of monkeys to a similar atmosphere for three months. In a more extreme test, rats and monkeys have been fed large doses of the compound for several months without harm. In other experiments, humans have been exposed to a concentration of about half-saturation for periods of months to three years without complaint or physiological effect.

Humidity, Dr. Robertson emphasized in his lecture, is an important factor in the vapor sterilization technique. The infection is spread from infected persons in droplet form by sneezing, coughing, and similar means. The humidity of the atmosphere is necessary to keep the bacteria surrounded by their fluid, because the triethylene glycol molecules, with a high affinity for water, accumulate rapidly around the fluid and "smother" the bacteria by stopping their respiration.

When the bacteria have an opportunity to dry, and are then suspended in the air, the vapor is ineffective except at humidities of 35 per cent or higher, which causes hydration of the bacteria and so permits the glycol action. Hence, dried bacteria may require 15 to 30 min to become hydrated and thus susceptible to the killing action of the vapor.

**Prevent RUST · SCALE · DIRT
From Clogging Steam Equipment**



YARWAY STRAINERS
"The Screen's the Thing"

- ***A High Grade Monel Woven Wire Basket*** **with mesh fine enough to catch the dirt—yet ample free area for passage of clean condensate, oil and other fluids.**
- ***Body Cadmium Plated Inside and Out for Protection Against Corrosion***
- ***Readily Removed Steel Blow-Off Bushing***

- ***Bushing Automatically Aligns Screen***
- ***Thousands in Use—Sold by Over 100 Mill Supply Houses***
- ***6 Sizes ½" to 2" for Pressures up to 600 Lbs.***

See Your Supply House or write for Bulletin S-200

YARNALL-WARING COMPANY
107 Mermaid Avenue PHILADELPHIA

The best humidities for effective action are from 40 to 60 per cent, though humidities as low as 35 are effective, Dr. Robertson found in the experiments. At the higher humidities, the triethylene vapor, if distributed through the atmosphere, will sterilize almost instantly. If the humidity is lowered to 25 per cent, the sterilization of the air is appreciably delayed.

In addition to triethylene glycol, propylene glycol and dipropylene glycol were found to fulfill the requirements for use as germidicidal vapors in atmospheres inhabited by human beings. They were unobjectionable, nonirritating, nontoxic, and sufficiently bactericidal, but a much higher concentration of either is required.

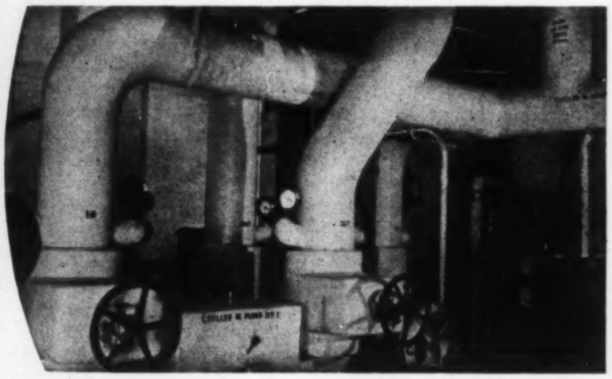
Effective use of the vapor sterilization technique, Dr. Robertson said, will depend upon engineering methods of obtaining correct humidity. One encouraging factor, however, is that in closed buildings during the winter, when infection is highest, the crowding together of large numbers of people normally increases the humidity through their respiration.

Because of the humidity factor, the vapor method requires control of the rate at which air is changed. When there are frequent and large changes, such as by opening of doors or windows, the control of humidity and concentration of the glycol is rendered more difficult.

An important advantage of the method is the relative cheapness of the glycols. In a room of 800 cu ft, where the air is changed twice an hour, 1 lb is sufficient to produce the sterilizing effect for approximately three months.

In the experimental work, Dr. Robertson used a very simple method of introducing the glycol into the air. A small amount was heated in a cup over an electric plate, and an electric fan, directed toward the ceiling, mixed the air and vapor. In other experimental work a regular heating installation was used, the heated air being blown over surfaces continuously moistened by the triethylene glycol. At the present moment, very little work has been done in determining how commercial installations can be used most effectively to distribute the vapor.

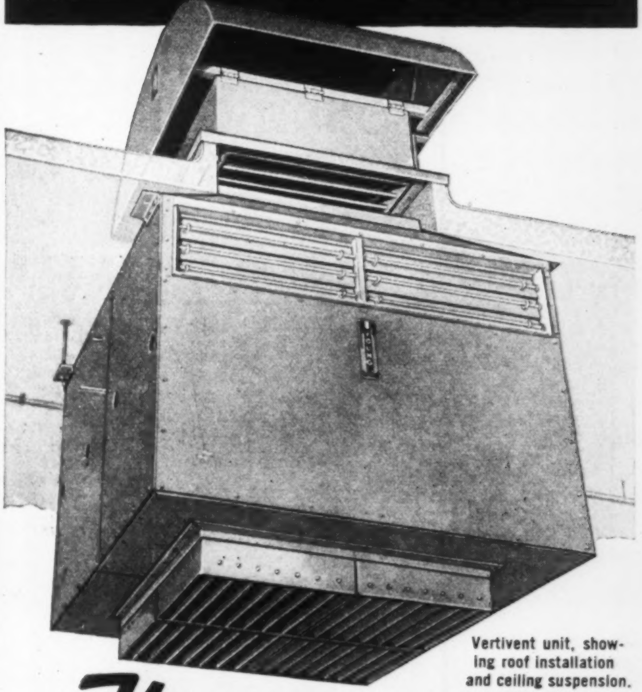
CORK INSULATION
Now Available for Air Conditioning!
(NO PRIORITY REQUIRED)



Mundet Cork Pipe Covering is made of 100% pure cork, which, due to its low conductivity, holds power costs to the minimum. Its high efficiency permits precise control of low temperature regardless of climate or season • Cold lines, low-temperature ducts, the walls, floors and ceilings of refrigerated rooms should be adequately protected by Mundet Cork Insulation in the form of Cork Pipe Covering and Corkboard • For test data, showing what Mundet Cork Insulation means in savings and operating efficiency, write to Mundet Cork Corporation, Insulation Division, 65 South Eleventh Street, Brooklyn, N. Y.

MUNDET CORK INSULATION
CONSERVES LOW TEMPERATURE

Young
COMPLETE VENTILATING UNITS FOR WAR PLANTS



Vertivent unit, showing roof installation and ceiling suspension.

Young VERTIVENT

Roof mounted, with a protecting light-proof fresh air hood, YOUNG Vertivent units assure complete ventilation in war plants 24 hours a day. Fresh air is drawn from the outside and distributed throughout the entire working area by efficient propeller-type fans. Young standard heat transfer coils properly temper the fresh air over a wide range of requirements from 100% outside air at minus 20° F or lower, to all recirculated inside air. For complete information and installation data, write to:

YOUNG RADIATOR COMPANY
Dept. 113E, Racine, Wis., U. S. A.

Manufacturers of a complete line of
AIR CONDITIONING UNITS
UNIT HEATERS
HEATING AND COOLING COILS

Buy Bonds — Produce More — Salvage Scrap — Win the War

Young
PRODUCT OF Young ENGINEERING AND MANUFACTURING SERVICE SPECIALIZING IN HEAT TRANSFER PRODUCTS

HEAT TRANSFER PRODUCTS
OIL COOLERS • GAS, GASOLINE, DIESEL ENGINE COOLING RADIATORS • INTERCOOLERS • HEAT EXCHANGERS • ENGINE JACKET WATER COOLERS • UNIT HEATERS • CONVECTORS • CONDENSORS • EVAPORATORS • AIR CONDITIONING UNITS • HEATING COILS • COOLING COILS

25 YEARS' SERVICE TO THE INDUSTRY

ACME PRODUCTS

REFRIGERATION AND AIR CONDITIONING EQUIPMENT

★ ★ ★

DRY-EX WATER CHILLERS

Controlled water velocity

Low refrigerant charge

Non-freeze

Direct expansion

Large volume water supply

Designed especially for Air-Conditioning indirect cooling. Write for Catalog No. 5.

★ ★ ★

STEEL PIPE COILS

LONGER LIVED BECAUSE OF RUGGED CONSTRUCTION

Defrosting is no problem.

ALL SURFACE IS "PRIME" SURFACE. GREATER LENGTH OF CONTINUOUS "TUBE" IS POSSIBLE

For both low temperature and higher bracket applications.

CAREFULLY TESTED IN WATER WHILE UNDER 300-LB. AIR PRESSURE.

Write for Catalog No. 26

★ ★ ★

FORCED CONVECTION UNITS

FLOOR AND CEILING MODELS FOR EVERY REQUIREMENT

High and Low Temperature Units

FINNED AND PLAIN SURFACE COOLING COILS

Dry, Water Defrost Continuous Brine Spray

CATALOG No. 32

ACME INDUSTRIES

JACKSON • MICHIGAN

Safe Limits on Mercury and Chromates

The American Standards Association, 29 W. 39th St., New York, N. Y., recently announced two new American standards on allowable concentration of chromic acid and chromates (Z37.7-1943), and allowable concentration of mercury (Z37.8-1943), each of which is available from the ASA at 20c per copy. The mercury standard is particularly important as the demand for mercury in the manufacture of munitions is now so great that every possible source is being explored, and mines which a short time ago were not worked because of the low grade of ore are now being worked on the 24 hr schedule. Chromium compounds are used extensively in the tanning industry, in photography, in dyeing, and, of course, in chromium plating.

Allowable concentration in the air of work places has been determined and approved by the American Standards Association for six other toxic substances in addition to the chromates and mercury. The other six standards, each of which may also be obtained for 20c per copy, are allowable concentration of carbon monoxide (Z37.1-1941), allowable concentration of hydrogen sulfide (Z37.2-1941), allowable concentration of carbon disulfide (Z37.3-1941), allowable concentration of benzene (Z37.4-1941), allowable concentration of cadmium, American war standard (Z37.5-1941), and allowable concentration of manganese, American war standard (Z37.6-1942).

New Jersey's Mineral Wool Industry

Bulletin 56, "The Mineral Wool Industry in New Jersey," was recently published by the Department of Conservation and Development, State of New Jersey, Trenton.

This bulletin was written to aid potential users of mineral wool in the selection of material best suited for their purposes and also for the benefit of the manufacturers of mineral wool whose costs are necessarily affected by the raw materials whose location, quality, and abundance are described in the report.

The report is on sale by the department at a price of 30 cents a copy.

Industrial Fire Brigade Training

An Industrial Fire Brigades Training Manual has been published by the National Fire Protection Association, 60 Batterymarch St., Boston, Mass. Comprising 176 pp., 8½ by 11 in., it may be obtained from the NFPA for $1.50.

Designed primarily for use in classes where employees are assigned to carry out firefighting duties under the direction of the chief of the private brigade, there are chapters on forcible entry practices, rope work, fire extinguisher practices, ladder and hose practices, salvage and overhaul, fire streams, ventilation practices for removing smoke and gases from a burning building, periodic inspections of plant fire protection equipment, care of the fire brigade's equipment, fire causes and fire hazards, firefighting procedure, flammable liquid and gas fires and special extinguishing systems, electrical fires, and gas masks and rescue practices.

This manual has numerous helpful photographs and sketches, and the great amount of information is presented in a most practical manner.

Salvaging Existing Refrigeration for Emergency Work

Walter L. Fleisher, consulting engineer, president of the Air and Refrigeration Corp., and a member of HPAC's board of consulting & contributing editors, spoke on salvaging existing refrigeration for emergency work at a meeting of the Cleveland section of the American Society of Refrigerating Engineers last fall. His paper was published in the April, 1943, journal of the ASRE.

"We must impress on the government and on the public," Mr. Fleisher said, "that if we consent to forego summer air conditioning today, it is because we recognize the emergency, and not because we concede for a moment that air conditioning and refrigeration have not been productive of better goods and better people who are able to produce better and more goods and better ideas for the successful prosecution of the war."

Among the wartime industries that require refrigeration —and for which refrigeration now used for comfort conditioning may be requisitioned—is synthetic rubber manufacture. Mr. Fleisher said that one ton of refrigeration per 100 tons a year of synthetic rubber would seem to be the required amount. For 800,000 tons of synthetic rubber a year, 8000 tons of refrigeration would be required—a little more than one-half the amount used in the War Department's new Pentagon building.

Mr. Fleisher's paper included curves of per cent capacity versus evaporating and condensing temperature, per cent horsepower versus evaporating and condensing temperature, and per cent horsepower per ton versus evaporating and condensing temperature, for both reciprocating and centrifugal refrigeration machines operating at constant speed. He also showed curves of horsepower and capacity for various leaving chilled water temperatures. He suggested that by allowing temperatures and humidities in conditioned spaces to rise somewhat above those theoretically required for comfort, the capacity of existing refrigeration equipment could be increased and it could thereby provide at least partial air conditioning for an enlarged building, rather than complete air conditioning in one part of the building and no air conditioning in the new part.

Another possibility for a department store operating on a 10 hr a day schedule, after one-half or three-fourths of its refrigeration has been diverted to war purposes, would be to operate the air conditioning system 24 hr per day. This would cool the mass of the building structure, and although part of the cooling effect would be lost outdoor during the daytime, the balance would be absorbed in the rooms and would be sufficient to carry over a fairly comfortable condition for a large part of the day.

ASTM's Book of Standards

The recently completed 1942 Book of ASTM Standards, issued in three parts, contains in their latest approved form all of the society's widely used specifications and tests for materials, definitions, and recommended practices. One of industry's most important books, the latest edition has 1090 specifications and standard methods which cover more than 4900 pp.

Continuing the policy first used with the 1939 book, the latest edition gives all specifications, whether formal standards or tentative. It is issued in three parts:

Part I.—Metals.—Ferrous and nonferrous metals (all A and B and some E serial designations) except methods of chemical analysis. General testing methods (E serial designations).

Part II.—Nonmetallic Materials—Constructional. Cementitious materials, concrete and aggregates, masonry building units, ceramics, pipe and tile, thermal insulating materials (all C serial designations). Timber and timber preservatives, paints, varnishes and lacquers, road materials, water-proofing and roofing materials, soils (certain D serial designations). General testing methods, thermometers (E serial designations).

Part III.—Nonmetallic Materials—General.—Fuels, petroleum products, electrical insulating materials, rubber, textiles, soaps and detergents, paper, plastics, water (remainder of D serial designations). General testing methods, thermometers (E serial designations).

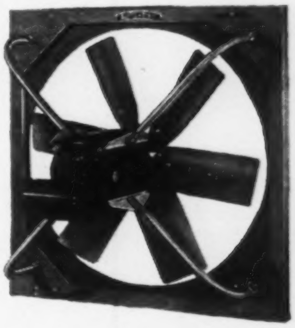
(The society is also issuing a new edition of its volume of chemical analysis of metals, including 21 widely used standards for both ferrous and nonferrous metals. This book will be issued later in 1943. These methods are not included in the Book of Standards.)

Each part of the 1942 book has a complete subject index. The part II index, for example, covers 32 pp., and there are two extensive tables of contents, the first listing all standards under general materials headings, and the second listing them in order of the sequence of the serial designa-

SUMMER HEAT AHEAD . .

Good Ventilation Promotes Efficiency...Reduces Absenteeism

HERMAN NELSON
Autovent
DIRECT DRIVE
PROPELLER FANS



DRIVE out summer's sluggish air with powerful Herman Nelson Autovent Propeller Fans. . . . Exhaustive tests in plants, factories and commercial establishments proved that the better working conditions made possible by an efficient ventilating system speed up production, lower the number of accidents, and reduce mistakes and time lost because of illness. Subsequently, absenteeism too is reduced. . . . Herman Nelson Autovent Propeller Fans operate efficiently and economically, even under severe conditions. They are ruggedly constructed to give many years of trouble-free service. Direct or belt drive designs. Available in wheel diameters 10 to 54 inches, capacities 670 to 22,690 cubic feet per minute.

SEND FOR FREE BOOKLET featuring Herman Nelson Autovent Propeller Fans for Ventilating Public, Industrial and Commercial Buildings.

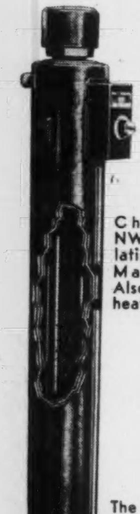
Sales and Service Offices in Principal Cities

The Herman Nelson Corporation MOLINE ILLINOIS

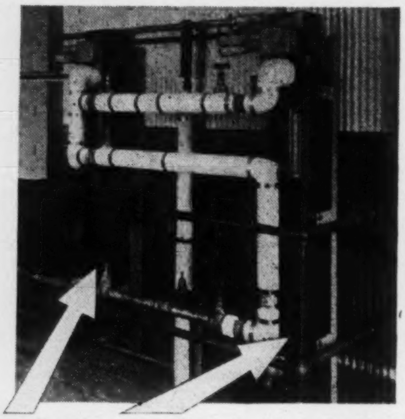
Autovent Fan & Blower Division, Chicago, Illinois

Manufacturers of
QUALITY HEATING, VENTILATING AND AIR CONDITIONING PRODUCTS

Summer Hot Water ELECTRICALLY Enables Steam Boiler Shut-Down



Chromalox NWH Circulation Heater. Many sizes. Also used for heating oil.



CHROMALOX
ELECTRIC Circulation Water Heaters

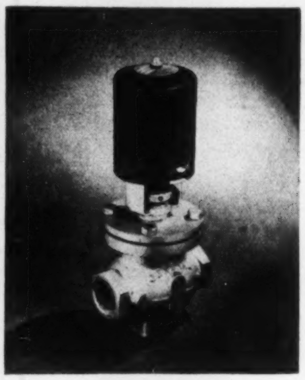
The 64-page Chromalox Catalog gives details on this and many other electric heating units, with much valuable engineering data. Write for a copy.

are connected in the water supply line. This is a simple piping job, with no complexities. The type NWH heating unit is complete, ready to be installed. Thermostatic control keeps water always the temperature you want. This arrangement for summer hot water, requiring no steam, is saving money and trouble in industrial plants everywhere. Let us help you work out the savings, and application details. Write.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. **Pittsburgh, Pa.**

SIMPLIFY MANY VALVE CONTROL INSTALLATIONS WITH GENERAL CONTROLS
HYDRAMOTOR VALVES

Provide Safe, Positive and Accurate Control of Water, Air, Gas, Steam and Oil



GENERAL CONTROLS SERIES G-1
Oper. pres. 3/8"—300 lbs.; 1½"—110 lbs.; higher pressures and larger I.P.S. sizes in G-3 and G-4 Series.

Series G Hydramotor Valves are available in industrial and commercial sizes from 3/8" to 6" I.P.S. or more, for all vapors, gases and fluids. The positive operation of these valves should appeal to every valve user. Entire operator is sealed in oil for life; no annual maintenance is necessary. Control is simplified, two-wire, current failure type, with external hydraulic operator. Available single seated, semi-balanced, normally open or normally closed. All voltages and all frequencies. Slow opening, slow closing. No gears, only one internal switch. All types described in Catalog No. 52. WRITE TODAY for your copy.

GENERAL CONTROLS
801 ALLEN AVENUE • GLENDALE, CALIFORNIA
BRANCHES: Boston, New York, Philadelphia, Cleveland, Detroit, Denver, Chicago, Dallas and San Francisco

---

GREEN LIGHT FOR INDUSTRY

*SARAN PLASTIC PIPE, TUBING, FITTINGS

SARAN by HODGMAN is a tough thermoplastic specially made to replace strategic materials. It is adaptable for use under high working and bursting pressures and is resistant to most chemicals. Its ease of handling makes it extremely valuable in installations requiring the transport of oil, gas and corrosive chemicals.

*Pat. No. 2160931

Send FOR COMPLETE INFORMATION SHEET AND FREE SAMPLE

HODGMAN RUBBER CO.
FRAMINGHAM, MASS.
NEW YORK 261 Fifth Avenue
CHICAGO 412 South Wells St.
SAN FRANCISCO 121 Second St

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

NoDrip A SURE CURE

● This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition surfaces. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance. A gallon covers about 30 feet of 1" pipe. Dries in 24 hours. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House.

FREE ***NoDrip Handbook. All about Condensation Drip and its Prevention.***

APPLY WITH BRUSH, TROWEL OR SPRAY

J. W. MORTELL CO.
Technical Coatings Since 1895
512 BURCH ST. KANKAKEE, ILL.

tions. These features are intended to facilitate reference to any subjects covered.

To keep the books up to date in 1943 and 1944, a supplement will be issued to each part in each of these years. As a service with the 1942 Book of Standards, there is a complete 200 p. index to standards, which is furnished without additional charge and a copy accompanies the purchase of each part or complete set.

The cost of each part is $9; the charge for supplements is $3 for each part, each year. For half-leather binding, add $1 extra for each part and each supplement part. Copies may be obtained from the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

Refractories

If there is a field of engineering which inconspicuously is fundamental to all modern technology, it is the branch known as refractories. Inconspicuous, one would say, in that the literature on the subject has had few text books contributed to it, and fundamental in that most basic raw materials of industry and the power for producing and processing them depend upon the application and use of refractories. In 1931, F. H. Norton, associate professor of ceramics at Massachusetts Institute of Technology gave us his first comprehensive treatment on this subject in the first edition of Refractories; the recently published second edition brings his work up to date. Few engineers could fail to find some portion of this new book valuable in some aspect of their practice.

The subject is essentially a branch of chemical engineering. Yet while all the necessary chemical theory and discussion are included, the reader whose chemistry has grown dull through disuse will not be hampered in using this book. It is a skilful blending of theory and practice. One can quickly find, with regard to any specific refractory problem, why certain materials are selected and how they are best utilized.

How thorough a job Professor Norton has done is well illustrated in his references to the world literature on refractories. In chapter 2, Literature on Refractories, the few books and many journals dealing with the subject are classified according to type of treatment: general, raw refractory materials, manufacture, high temperature measurements, optical crystallography, bibliographies, and abstracts. In eight pages there is condensed a complete summary of all important material that has been and is being published about refractories. But equally important are the specific references at the end of each chapter; how prolific can be judged from two examples: following chapter 8, Drying, are 45 citations, and after chapter 17, Heat Transmission by Refractories, are 65. Finally, the author index, distinct from the subject index, lists about 1100 names of authors cited.

The book is divided into four parts and an appendix. Part 1, the introduction, contains four chapters. In addition to summarizing the history and development of the refractory industry, it contains, in chapter 4, Some Fundamental Concepts of Matter in the Solid State, about 100 pages dealing with modern concepts of crystalline structure, prepared by Dr. William Parrish of the geology department of Pennsylvania State College. Anyone wanting a short course on crystallography could hardly find a more excellent treatise. Part 2 has seven chapters and is entitled Manufacture. The nature and occurrence of clays and other refractory minerals, their mining and processing into firebrick, cements and mortars, constitute the subject matter. There is a thorough discussion of kilns, their construction, and operation. The illustrations and citations are profuse.

Of special interest to readers of HPAC will be that portion dealing with fuels and fuel burners as applied to the firing of kilns of all types. In part 3, Properties, there are eight chapters, all of which will be of interest to heating men. Here will be found the answers to many questions encountered by men working with boilers and boiler settings, such as the behavior of firebrick and related materials under various conditions of use and service. Part 4, with

WARNS WHEN AIR-FILTER CLOGS WITH DIRT

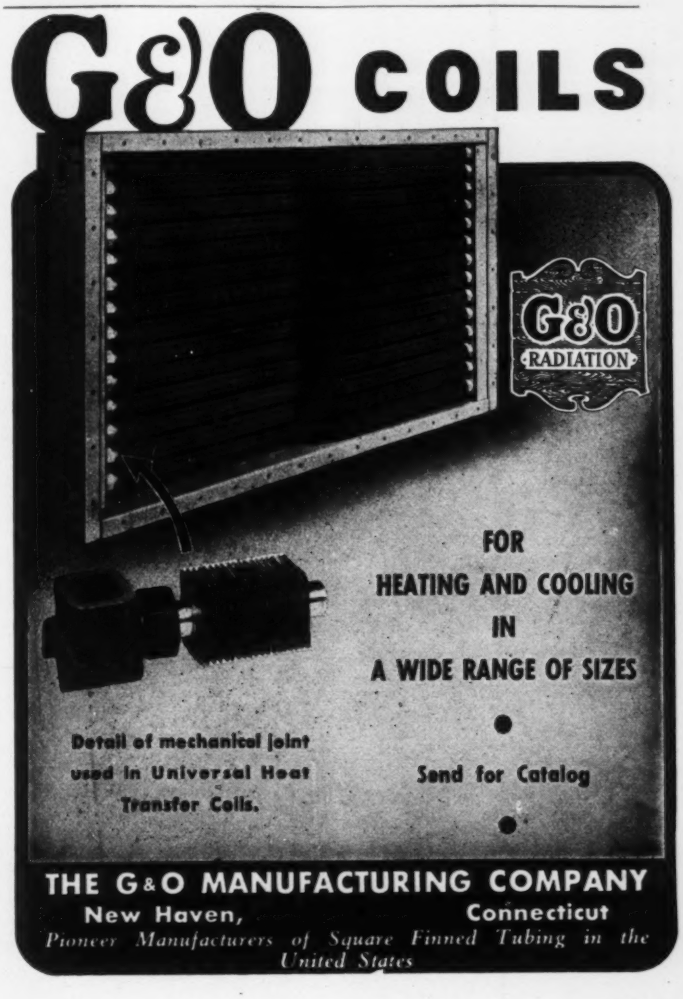
DIRT clogged filters in the air circulating system mean reduced efficiency and added power costs. On the other hand, changing filters oftener than necessary represents money wasted.

Install a Hays Air-Filter Gage and know exactly just how dirty and inefficient your filters are. An indicator shows the air resistance at all times. When the resistance becomes excessive an alarm is sounded or signal flashed. A high quality precision instrument by pioneer instrument makers. Write 990 Eighth Avenue, Michigan City, Indiana for special bulletin 37-278.

HAYS AIR-FILTER GAGE

TELLS CONDITION OF FILTER AT ALL TIMES

The HAYS CORPORATION
SINCE 1901
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A

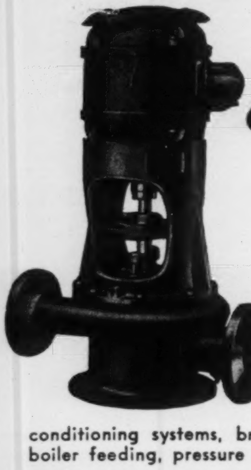

G&O COILS

FOR HEATING AND COOLING IN A WIDE RANGE OF SIZES

Send for Catalog

Detail of mechanical joint used in Universal Heat Transfer Coils.

THE G&O MANUFACTURING COMPANY
New Haven, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States



PERFORMANCE PLUS
with
Economy
SCV
Pumps

Economy's new vertical type pump for clear liquid services. Highly recommended for hot and cold water circulation, air conditioning systems, brine circulation, sprinkler equipment, boiler feeding, pressure boosting, etc.

- Vertical in design—saves floor space.
- Motor high and dry—away from splash and dirt.
- Complete rotor easily removed without disturbing piping connections.
- Impeller keyed to extra heavy shaft rotates between both an outboard and inboard bearing—smooth and noiseless operation.
- Built in sizes with discharges 1" to 3", for capacities from 10 to 500 GPM, with heads up to 225 feet.

Write for fully illustrated and complete descriptive Catalog No. D2-1042.

ECONOMY PUMPS, INC.
1011 WELLER AVENUE — HAMILTON, OHIO

*Downright
DEPENDABILITY
for day after day, year after year service... Proved by thousands of users everywhere

FIRE-GUARD
Automatic Coal Stokers

Industrial Sizes: 70, 100, 150, 200, 300 and 400 pounds per hour capacity
--also built in domestic sizes

PEERLESS MFG. CORP.
INCORPORATED
Louisville, Ky.

its five chapters, considers the applications of refractories, classified broadly as metallurgical, power generation, and miscellaneous. The final chapter treats of firebrick construction. The appendix presents data pertaining to pyrometry.

The outstanding feature of the book is its universality. Within itself it not only encompasses the technology of the refractory industry, but it ties up that industry with an endless list of other industries. It bewilders one to reflect upon the host of things that have their beginning and depend for their existence upon the availability of the proper heat resistant substances: iron and steel, copper and other nonferrous metals, glass, lime and cement, coke, and other fuels. Other apparatus and processes equally dependent upon refractories are steam generators, paper mills, enameling and other types of ovens and furnaces, food processing, heating systems, incinerators, chemical plants, petroleum refineries. Therein lies the great value and usefulness of Professor Norton's book—there is scarcely a field of engineering that will not derive useful information and assistance from it.

The heating engineer will regret that of its almost 800 pages the author could afford to devote but one short chapter to refractories in steam generation as such, but actually the book is replete with data and information equally applicable, and the ample index affords a ready means of locating it quickly. In chapter 11, for instance, the full story of refractory mortars, plastics, concretes, and coatings will be found. With this book at his disposal, every engineer involved in the design, construction, or maintenance of boiler furnaces will be posted on the nature, behavior, and usefulness of not only the commonly used firebricks and high temperature cements, but of the latest developments in superduty refractories, chrome ore for water cooled boiler walls, fire resistant insulators, and plastic firebrick construction. And he will not overlook the opportunity to refresh his memory on the various methods of firebrick construction, including special types of suspended walls and arches, and air cooled settings.

The book is published by the McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y.; it has 798 + xiv pages, 6 × 9 in., including 405 illustrations and 135 tables. The price is $7.50.—K.S.

Coming Events

Refrigerating Engineers

American Society of Refrigerating Engineers: 30th spring meeting, June 1-3, Hotel Statler, Cleveland, Ohio. Papers scheduled include low temperatures by means of multistage and other compression systems, by Harry Sloan, Vilter Mfg. Co.; insulation for low temperatures, by John F. Stone, Johns-Manville; refrigeration and the War Production Board, by Sterling F. Smith, War Production Board; present practice in selection metals for use with corrosive substances, by W. Z. Friend, International Nickel Co., Inc.; fundamental concepts of corrosion, by Robert B. Mears, Aluminum Co. of America; corrosive inhibitors, by V. V. Kendall, National Tube Co.; organic coatings, by G. W. Seagren, University of Pittsburgh; cathodic protection, by R. H. Brown, Aluminum Co. of America; industrial low temperature cabinets, by R. H. Swart, Kold-Hold Mfg. Co.; refrigeration of electrodes in welding, by Walter G. Moehlenpah, Weltronic Corp.; mobile and portable refrigerators for the armed forces, by Mark E. Mooney, Carrier Corp.; synthetic rubber, by O. D. Cole, Firestone Tire and Rubber Co.; and refrigeration activity through the WPB advisory committee, by Marshall G. Munce, York Ice Machinery Corp. Headquarters office of the ASRE is at 50 W. 40th St., New York, N. Y.

De-Sta-Co
Blower Wheel Housings

of Standard Dimensions

Made in sizes to fit 4½, 5, 6, 7½ and 9 inch wheels and in widths to suit single or double inlet wheels . . . also individual parts for your own assembly.

De-Sta-Co housings are engineered for maximum efficiency and quietness in operation . . . neatly finished. Send for "De-Sta-Co Blower Housings" bulletin; gives complete information, including essential dimensions.

DETROIT STAMPING CO.
Established Over 25 Years
337 Midland Ave • Detroit, Mich.

HYDRON
Metal Bellows

HYDRON
METALLIC BELLOWS

We manufacture HYDRON bellows and bellows assemblies ready for installation in steam traps, relief valves, temperature regulators, pressure regulators, air valves, and automatic temperature and pressure controls, including aircraft engine cooling systems, carburetors, and super-chargers. We also manufacture HYDRON extruded tubing for aircraft prestone radiators, oil coolers, inter-coolers, and after-coolers, for liquid-cooled and air-cooled motors.

CLIFFORD MANUFACTURING CO.

CHICAGO 221 N. LaSalle Street	564 East First Street BOSTON, MASS.	DETROIT 6432 Cass Avenue

X-PANDO
EXPANDS AS IT SETS

Standard PIPE JOINT COMPOUND in AMERICAN INDUSTRY

X-PANDO

7 IMPORTANT ADVANTAGES

1. X-Pando is the only pipe joint compound that *expands as it sets.* Not effected by vibration, sharp temperature changes, deflection or pressures.
2. One formula for all uses.
3. Better than Litharge and Glycerine for all uses. Ideal for all refrigerant lines.
4. Corrects imperfections in threads; smooths flange faces.
5. Expands and contracts with pipe movement.
6. Economical – goes four to six times further than *any other compound.*
7. Used for all joints and types of lines. Holds anything carried in metal pipe except certain heavy acids. Yet joints may be easily taken apart.

Used by U. S. Navy — U. S. Maritime Commission — U. S. Army — U. S. Army Air Corps.

DISTRIBUTORS EVERYWHERE

X-PANDO CORPORATION
43-15–36th Street Long Island City, N. Y. STillwell 4-7180

POWERS
TEMPERATURE and HUMIDITY
CONTROL

When you want accurate and dependable automatic temperature or humidity control for Industrial Processes or Air Conditioning Systems call in a Powers engineer. With a very complete line of self-operating and compressed air operated controls we are well equipped to fill your requirements.

Write for Circular 2520

THE POWERS REGULATOR CO.
2759 Greenview Avenue, CHICAGO

Offices in 47 Cities—See your phone directory

50 Years of Temperature and Humidity Control ★

SAVE WITH SARCO

Water Blenders

Here is a simple, sturdy, thermostatic mixing valve of many uses.

It will mix hot and cold water to provide blended water at any desired constant temperature. When used in connection with gang showers or group wash basins, it preserves hot water storage and will often make unnecessary the acquisition of additional heater capacity.

It brings tempered wash water right to the point of use in dairies, packing houses, or sheet mills. It provides accurate proportioning control for photographic and X-ray film washing.

Used to recirculate a varying portion of the cooling water, it saves water and lubricating oil and protects Diesel engines, compressors, or condensers. On brine unit coolers, it provides an accurate, compact and inexpensive temperature control.

A special type is available also for submerged heating coils and tankless water heaters connected to heating boilers in large or small buildings, to prevent scalding hot water reaching bath room fixtures. Catalogs 700 and 800.

153

SARCO SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
Sarco Canada Ltd., Federal Bldg., Toronto, Ont.

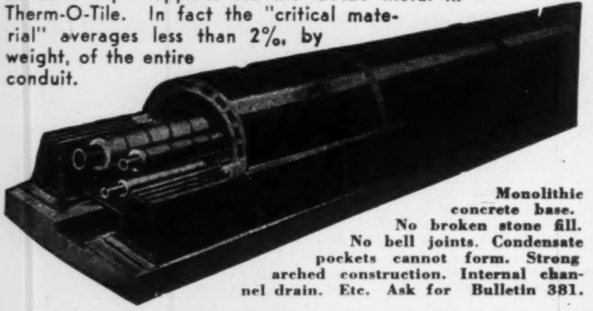
Less Than 2% "Critical Material" in

THERM-O-TILE

Reg. U. S. Pat. Off.

Underground Pipe Conduit

The most important test for every decision today is: "Will it help win the war?" Applied to Therm-O-Tile the answer is definitely "Yes". You save MUCH metal when you use this conduit. Pipe supports are the ONLY metal in Therm-O-Tile. In fact the "critical material" averages less than 2%, by weight, of the entire conduit.



Monolithic concrete base. No broken stone fill. No bell joints. Condensate pockets cannot form. Strong arched construction. Internal channel drain. Etc. Ask for Bulletin 381.

Sold and installed by Johns-Manville Construction Units in all Principal Cities. See our page in Sweet's or The Heating Guide.

H. W. PORTER & CO., Inc.
822H Frelinghuysen Ave., Newark, New Jersey

Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

Clip your name, firm, and address to this ad; tear out with the checked squares above, mail, and you will hear from us promptly.

Heating and Ventilating Engineers

American Society of Heating and Ventilating Engineers: Semi-annual meeting, June 7-8, Hotel William Penn, Pittsburgh, Pa. See ASHVE Journal Section in this issue for further information. Secretary of the ASHVE is A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Smoke Prevention

Smoke Prevention Association: 37th annual meeting, June 8-11, Hotel William Penn, Pittsburgh, Pa. The program includes papers on probability of error in sampling coal, by Henry F. Hebley, Pittsburgh Coal Co.; smoke tendencies of coals, by H. J. Rose, Mellon Institute of Industrial Research; smoke from the viewpoint of the chemist, by E. Berl, Carnegie Institute of Technology; collection of fly ash from spreader stokers, by K. H. Bowman, Dravo Corp.; determination of fly ash, by D. D. Pendleton, Buel Engineering Co.; design and application of overfire air jets, by R. B. Engdahl, Battelle Memorial Institute; overfire air performance applied to stationary plants, by Harry Carroll, Commercial Testing and Engineering Co.; application of overfire air and its relation to the smokeless operation of locomotives, by E. D. Benton, Louisville & Nashville R. R. Co.; review of surveys of heating and power plants made in various cities with recommendations for the elimination of smoke, by Carroll F. Hardy, Coal Producers Committee for Smoke Abatement; the flow of the four fluids, by R. J. Bender, Sinclair Refining Co., burning wood waste in power plant boiler furnaces, by B. H. Whitehouse; and railroad smoke control in Pittsburgh, by W. H. Kimberly, Pittsburgh Bureau of Smoke Prevention. Sumner B. Ely is chairman of the arrangements committee. Headquarters office of the SPA is at 139 N. Clark St., Chicago, Ill.

District Heating

National District Heating Association: 34th annual meeting, June 9-10, Hotel Schenley, Pittsburgh, Pa. This is to be a "strictly technical meeting devoted to wartime problems of steam utilities." Among the papers scheduled, in addition to committee reports, are heat consumption of the two research committee typical buildings, by F. Lee Rapson; hot water consumption of buildings, by Albert F. Metzger; changes in hot water and steam use due to the war; wartime commercial activities of utility members, by George H. Tuttle; results of 59 automatic temperature control installations, by Mr. Tuttle; meter maintenance problems due to difficulty of obtaining critical materials, by R. H. Brown; testing condensate meters by testing drums only, by J. C. Butler; methods and materials used in cleaning meter drums, by R. J. Bodin; progress report on weather statistics, by John F. Collins, Jr.; the chemistry involved in some unusual uses of steam and condensate, by Louis Shnidman; mechanism of the dissolution of carbon dioxide in steam heating equipment, and activities of the American coordinating committee on corrosion, both by Leo F. Collins; wartime practice in materials and equipment, by A. A. Sellke; safety rules for district steam system operation, by Dwight L. McNulty; damage to insulation by flooding, by W. W. Stevenson; and methods of protecting materials in manholes, by Paul Chenzoff. Secretary-treasurer of the NDHA is John F. Collins, Jr., 827 N. Euclid Ave., Pittsburgh, Pa.

Building Owners and Managers

National Association of Building Owners and Managers: 36th annual convention, June 21-24, Saint Paul Hotel, St. Paul, Minn. Wartime problems and government regulations affecting large commercial properties will be featured. There will also be an operating methods and equipment exhibit. Assistant secretary of the NABOM is W. J. McLaughlin, 134 S. La Salle St., Chicago, Ill.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1943, Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.

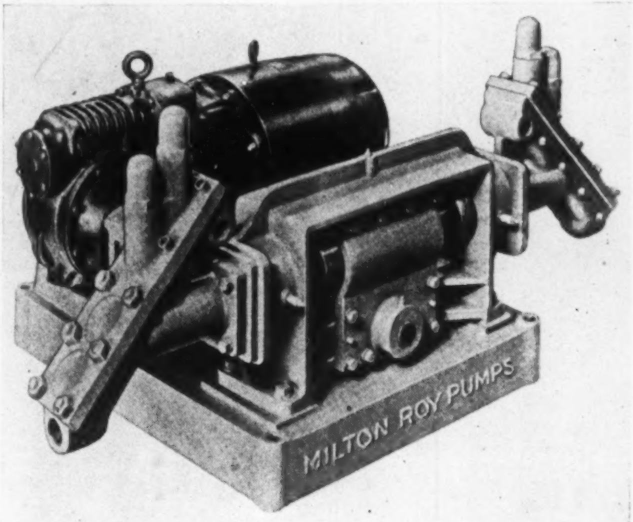
Asbestos Cement Pressure Pipe

No. 2446—A new product, called "Eternit" asbestos cement pressure pipe, was recently introduced for use in many branches of industry, such as chemical plants and pulp and paper mills, and for use in waterworks, drainage, and irrigation systems. It is made by a patented extrusion process which insures uniform measurements and extremely smooth surfaces, both inside and out, says the manufacturer. When necessary, the pipe can be cut in the field with a hack saw and can be coupled immediately without machine preparation.

This pipe is of course not subject to rust and being a nonconductor of electricity is unaffected by stray ground currents. It is made in standard lengths of 13 ft and in diameters up to and including 6 in. For the present it is available only in the eastern seaboard states.—Ruberoid Co., 500 Fifth Ave., New York, N. Y.

Pump for Synthetic Latex

No. 2447—A pump developed especially for handling the butadiene-styrene mixture which forms chemical rubber latex employs a typical step valve design with double ball checks but is modified slightly to enable latex to be handled with a minimum of turbulence. The discharge checks are spring loaded to enable them to seat instantly and positively in handling this viscous material.

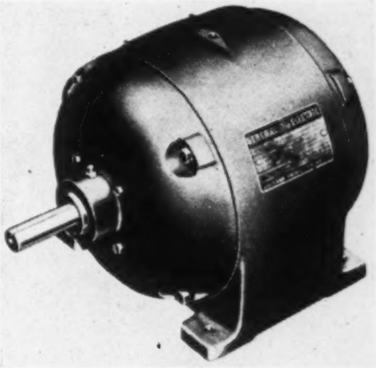


An opposed end duplex pump, it is designed to utilize the suction pressure present in the mixing vessel and pump against a greater pressure on the discharge end. An important feature is a close plunger stroke adjustment by means of which the volume of latex handled may be controlled from maximum pump capacity down to as little as desired.

This pump is available in capacities up to 3000 gph.—Milton Roy Pumps, 1371 E. Mermaid Ave., Philadelphia, Pa.

Totally Enclosed Motors

No. 2448—A new line of totally enclosed "Tri-Clad" motors has been especially designed for use under conditions where abrasives, chemicals, rain, snow, and excessive dirt are encountered. They are available in both the polyphase 60 cycle induction type, and the single phase 60 cycle capacitor type.



Features include protection against physical damage, electrical breakdown, and normal operating wear and tear. In addition, all parts of the motor enclosures are cast iron, thus offering exceptional resistance to rust, corrosion, accidental blows, and rough use, according to the manufacturer. The leads are permanently encased in compound in a cast-in pocket in the stator frame to prevent liquids from seeping into the motor. — General Electric Co., 1 River Rd., Schenectady, N. Y.

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [6-43]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature.

(Circle each number in which you are interested):

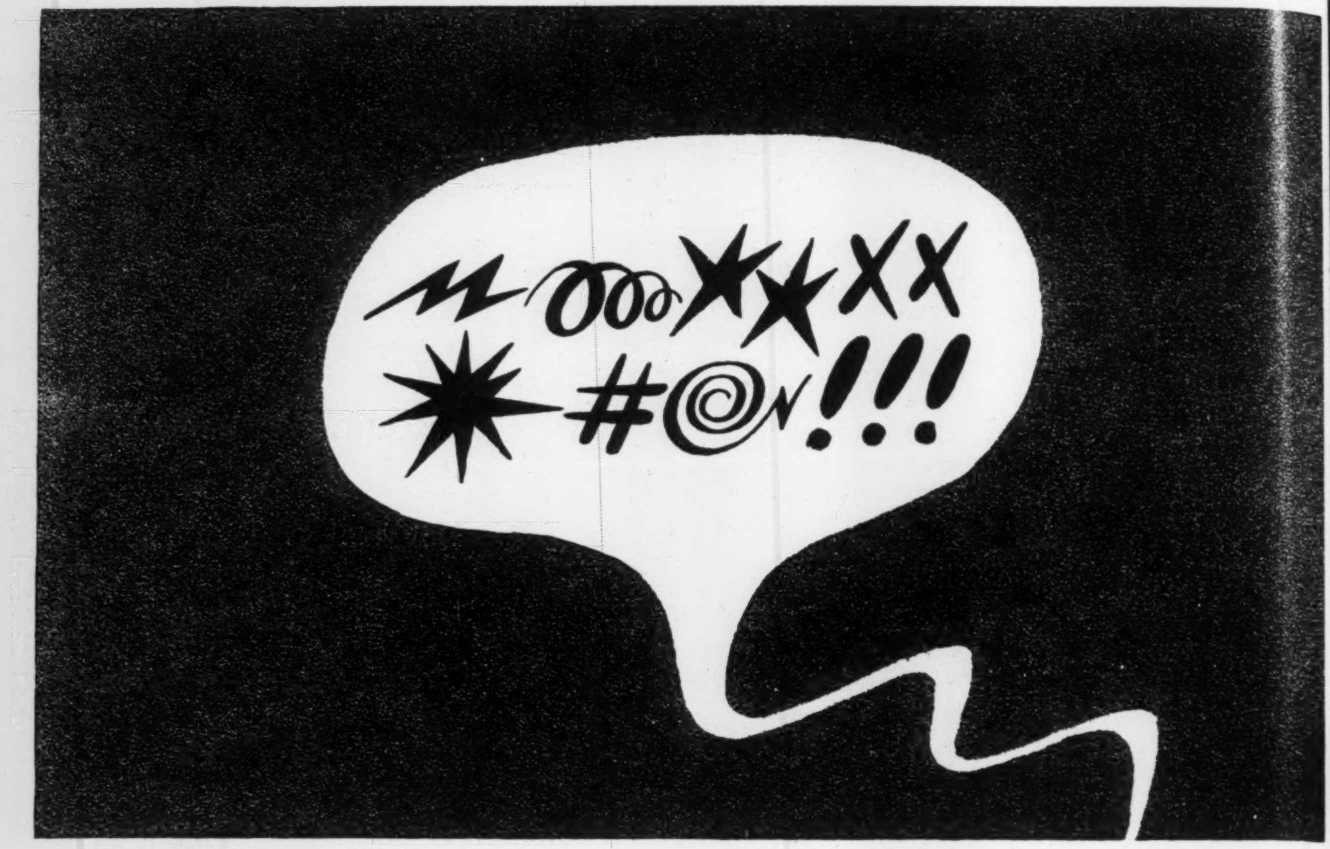
2446 2447 2448 2449 2450 2451 2452 2453
4453 4454 4455 4456 4457 4458 4459 4460 4461 4452
4463 4464 4465 4466 4467 4468 4469 4470 4471 4472
4473 4474

Name........................... Title..............

Company ....

Address ....

City............................ State............



What does a speck of dust sound like?

In a telephone receiver, a speck of dust doesn't sound like anything. Why? Because most automatic telephone exchanges today operate in dust-free air . . . a speck of dust just couldn't get in.

TELEPHONE ENGINEERS realized, many years ago, that a speck of dust or lint could interfere with the proper closing of automatic switches and cause static-like noises during conversation. So now, most men in charge of ventilating systems install Dust-Stop* Air Filters, which keep dust and dirt away from delicate mechanisms.

Plant and maintenance engineers are also well aware of the damage which dust can do to practically any precision instrument. They know that it can interfere with the accuracy of a gun sight . shorten the life of a high-speed motor.

That's why many alert engineers today insist on Dust-Stop filtered air for precision manufacturing operations. For Dust-Stops have proved and are proving their efficiency and economy in scores of important war plants. They are protecting delicate parts from dust damage . . . guarding accurately machined and carefully painted surfaces.

Outstanding Dust-Stop advantages include:

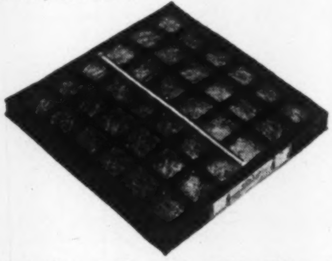
PERFORMANCE: Capacity, 2 CFM per sq. inch of area at 300 FPM. Average resistance, new, in inches of water gauge, .062 for the 1-inch, .13 for the 2-inch.

ECONOMY: Cost only 1¢ per CFM as original equipment for industrial installations. Less than 1/10th of 1¢ per CFM to replace.

MAINTENANCE: Filters can be cleaned by vacuuming or rapping out. This practice can be repeated once or twice to reduce maintenance costs.

AVAILABILITY: Made from all-American materials which are not now listed as critical. Production is being expanded to growing requirements.

Investigate the efficiency and low cost of maintaining dust-free air by replacing Dust-Stops at regular intervals. If your regular supplier cannot give you full technical data, write today to *Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*



• This is the new Dust-Stop War Filter. Note the square grille of heavy Kraft fiberboard. This replaces the metal grille with round openings formerly used.

ARMY NAVY E

FIBERGLAS* DUSTOP* AIR FILTERS

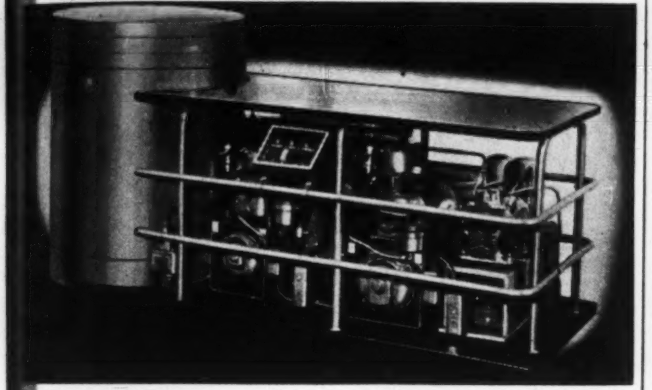
*T. M. Reg. U.S. Pat. Off.

Speeds Action of Large Diaphragm Valves

No. 2449—A booster relay air valve to enable better process control through faster operation of large diaphragm valve motors, or of valves situated unusually long distances from controlling instruments, provides accelerated valve action to eliminate the effect of lag in the diaphragm motors or in the long air lines. According to the manufacturer, the relay will inflate or deflate the largest of the manufacturer's valve motors from five to seven times faster than by controller alone.

It is installed in the air line adjacent to the diaphragm motor and actuates the diaphragm valve by means of an independent air supply of 25 to 150 psi pressure.—Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.

Industrial Chilling Machine



No. 2450—A new and improved "Deepfreeze" cascade industrial chilling machine has been designed for widespread application throughout industry in the shrinking, treating, and testing of metals. Among the features recently added to increase its operating efficiency are a temperature controlling device for accurate control of any point from atmosphere to —120 F, a table top for convenience and safety, and an arrangement of three compressors and three motors to develop maximum thermal efficiency and eliminate necessity of water connections and drain facilities.

Employing two stage refrigeration, the machine has capacity at —120 F to remove 1000 Btu per hr when the work is immersed in the convection fluid, says the maker. One of the important applications of the machine is the shrinking of metal to permit assembly of sleeve bearings and ball or roller races otherwise requiring a press fit by merely slipping them into position after chilling.—Deepfreeze Div., Motor Products Corp., 2301 Davis St., North Chicago, Ill.

Flanged Glass Pipe and Fittings

No. 2451**—A line of flanged glass equipment in ¼, ⅜, ½, and ¾ in. sizes for use in laboratories and for pilot plant and semiworks projects was recently announced. The flanges are of the same general construction as used in the process industries for plant size stoneware and glass joints. A glass stub flange having a tapered neck is fitted with a fiber sleeve. A metal ring flange contains a tapered hole that will pass over the glass stub when the fiber sleeve is not in position but will jam tight after the sleeve has been inserted.

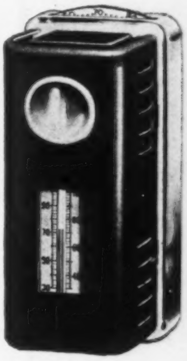
The standard material for the flanges is malleable iron,

HYDRAULIC ACTION CONTROL

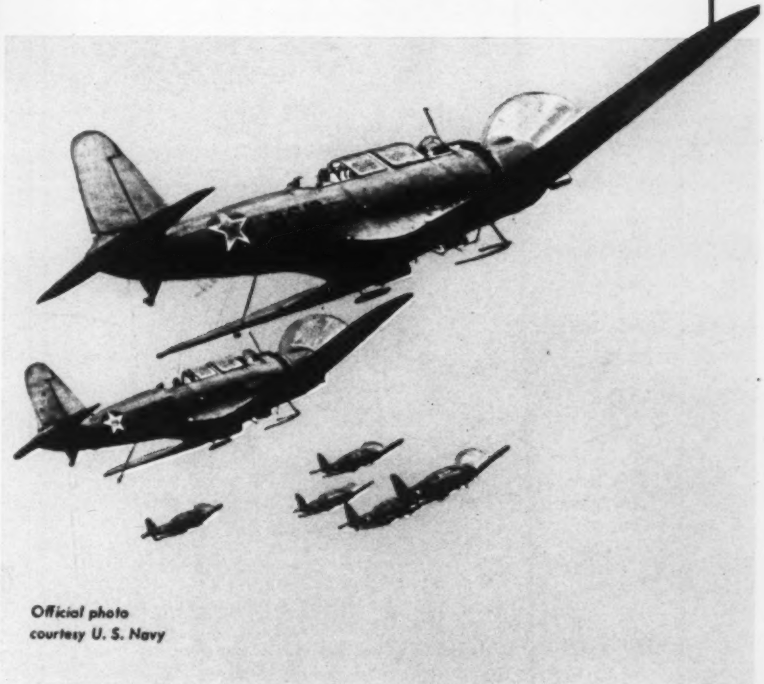
Today, the greater portion of White-Rodgers manufacturing facilities is devoted to the manufacture of aircraft controls.

In the design and manufacture of this wartime equipment new applications of the White-Rodgers Hydraulic-Action principle of temperature control are being developed — applications that one day will bring added safety and convenience to a world at peace.

Until then, standard temperature and pressure controls for heating and refrigeration are available for high priority installations essential to the war effort.



Series 150 Heavy-Duty Line Voltage Room Thermostat — will handle multiple unit coolers or heaters—available with locked dial and "on," "automatic" and "off" dial positions to serve as manual control.



Official photo courtesy U. S. Navy

WHITE-RODGERS ELECTRIC CO.
1205f CASS AVE. ST. LOUIS, MISSOURI

Controls for Heating • Refrigeration • Air Conditioning

25 Years' Service to the Industry

ACME PRODUCTS

Refrigeration and Air Conditioning Equipment

FREON SHELL and TUBE CONDENSERS

Capacities 2½ Tons to 450 Tons

Copper or Steel Tubes

Cleanable

Many Water Pass Combinations

Larger Sizes Cleanable Without Breaking Water Connections. *Ask for Catalog 23.*

HEAT EXCHANGERS

SUCTION LINE

LIQUID INLET · GAS INLET · GAS OUTLET · LIQUID OUTLET

CAPACITIES—1 TON TO 180 TONS

Increases expansion valve capacity . . . prevents line vibration and chattering valves . . . often increases compressor capacity . . . prevents liquid return to compressor . . . eliminates suction line sweating. ***Catalog No. 12.***

DRY-EX WATER CHILLERS

Designed especially for Air Conditioning indirect cooling, direct expansion, large volume water supply, controlled water velocity, low refrigerant charge, non-freeze. Catalog No. 5.

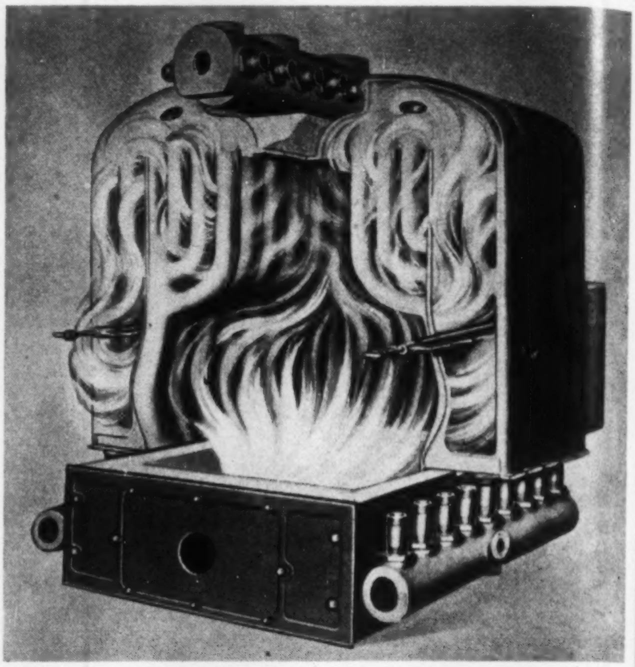
ACME INDUSTRIES

Jackson • Michigan

although bronze can also be supplied from stock, and other metals furnished to special order. "Pyrex" glass is used.—Fischer & Porter Co., Hatboro, Pa.

Cast Iron Boilers

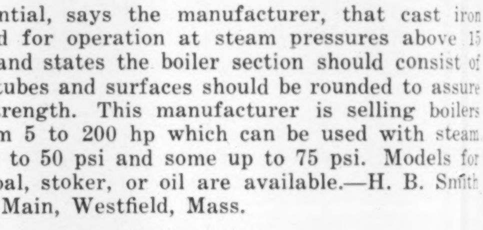
No. 2452—When it is impossible to secure steel boilers for operating pressures from 15 to 75 psi, one answer is to consider the use of a cast iron boiler which has been designed to operate successfully at such pressures, according to a maker of cast iron boilers and radiators, who states that the Navy has over 50 cast iron boilers on one project alone providing steam for 30 psi pressure for sterilization purposes. An industrial plant is using a cast iron boiler to supply 300 F temperature water for process requirements.



It is essential, says the manufacturer, that cast iron boilers suited for operation at steam pressures above 15 psi be used and states the boiler section should consist of many small tubes and surfaces should be rounded to assure maximum strength. This manufacturer is selling boilers rated at from 5 to 200 hp which can be used with steam pressures up to 50 psi and some up to 75 psi. Models for hand fired coal, stoker, or oil are available.—H. B. Smith Co., Inc., 57 Main, Westfield, Mass.

Pipe Alignment Guide

No. 2453—The new "Adsco Model G" pipe alignment guide is an improved product which has been redesigned to save critical metal and machining operations, the maker announces. It is used on steam, hot water, fuel oil, or other pipe lines adjacent to expansion joints to insure true alignment of pipes in service.



It consists of a semi-steel spider and guiding cylinder allowing for a pipe movement of 8 in. To install, the lower half of the guiding cylinder is bolted into place, the two piece spider is bolted to the pipe, the pipe is then insulated and the upper half of the cylinder bolted to the base section.

In service, the four "fingers" of the spider ride on the inside of the cylinder, which is coated with heavy grease before shipment, to provide true pipe alignment.—American District Steam Co., 25 Bryant St., North Tonawanda, N. Y.

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 127. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Arc Welders

No. 4453—12 p. bulletin (GEA-1440J) on direct current, single operator arc welders describing the operation of these engine or motor driven welders and showing construction details.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Atomizing Spray Nozzles

No. 4454—2 p. data sheet on atomizing spray nozzles for air conditioning applications providing a 95-115 deg spray, showing sizes, capacities, and prices.—Jos. A. Martocello & Co., 229 N. 13th St., Philadelphia, Pa.

Axial Flow Blowers

No. 4455—8 p. bulletin (CO-5) on axial flow blowers with "Voltrol" vanes, single stage and two stage. Important features of these blowers are described, numerous installations are shown, and performance curves are presented.—L. J. Wing Mfg. Co., 14th St. and 7th Ave., New York, N. Y.

Brazing

No. 4456—4 p. bulletin giving information regarding the design of low temperature silver alloy brazed joints.—Handy & Harman, 82 Fulton St., New York, N. Y.

Electric Gages

No. 4457—8 p. bulletin (GEA-3991) describing the functions of 21 electric gages to aid production and showing schematic representations of electric gage circuit applications. Among those described are thickness, magnetic, electro-limit, pressure, strain, and eccentricity gages.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Flexible Joints

No. 4458—New book covering the problems of valve controls, manual ventilation control, remote controls, universal joints, shaft joints, shaft couplings, shaft hangers, shaft assemblies, hinged joints, universal joint covers, shaft expansion couplings, operating gears, and engine controls. Descriptions of two new joints are given, a consolidated hinged joint with a positive and effective operating range at angles from 0-92 deg in any one given plane, and a universal joint with an operating range at angles from 0-360 deg in any plane.—Brooks Equipment Corp., 90 West St., New York, N. Y.

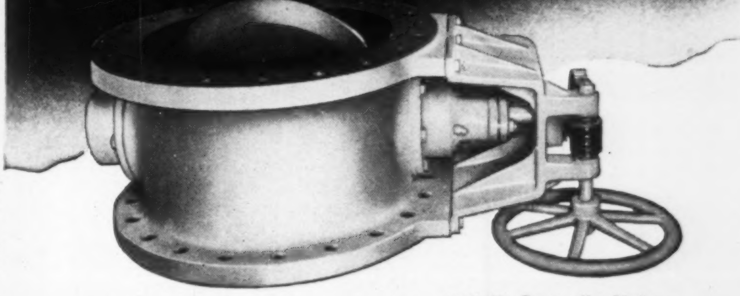
Lignum Vitae

No. 4459—12 p. bulletin comprising a report on wartime uses of lignum vitae, a material that is substituting for critical metals and plastics in various industrial applications.—Lignum-Vitae Products Corp., 96-100 Boyd Ave., Jersey City, N. J.

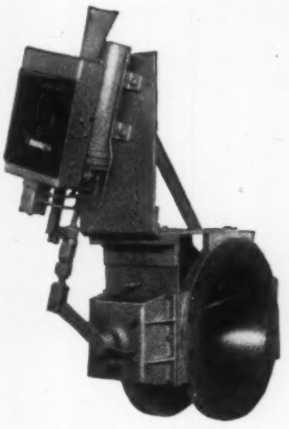
Measuring and Control Instruments

No. 4460—16 p. bulletin (Z6200) comprising a condensed catalog with short descriptions and current prices for all of the manufacturer's instruments.—Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill.

Service Duration Tripled with R-S BUTTERFLY VALVES



125-lb Butterfly Valve with hand wheel control, American Standard flanges.



150-lb Class B steel valve with automatic controller.

THE CASE HISTORY of a 6-inch, 125-lb R-S Butterfly Valve illustrates the advantages and increased service to be obtained from this type valve. It was installed in a line leading to a condenser and used for shut-off under 70 lbs pressure.

Previous installations of conventional type valves did not hold up and had to be replaced *every six to eight months* as the abrasive action of the fluid in the form of a high pressure "jet" wore a hole through the casing. When an R-S Butterfly Valve with "A" Metal was installed, the length of service was tripled.

Here is concrete evidence that even abrasive materials "fan out" into a crescent-shaped spray when the Butterfly Vane approaches a closed position. This fact, coupled with the use of "A" Metal in an R-S Butterfly Valve, produces outstanding results where hard wear and severe stresses are encountered.

The Butterfly Vane is not a "flopper". It is beveled and wedges against the valve body when closed. Compare—results prove the superior efficiency of this type valve under high or low pressures and temperatures.

Your R-S Distributor will gladly furnish detailed information.

R-S QUALITY PRODUCTS SINCE 1908

15 to 900 psi

VALVE DIVISION
R-S PRODUCTS CORPORATION
132 Berkley Street • Philadelphia, Pa.

R-S Streamlined BUTTERFLY VALVES

TO HIT 'EM H-A-R-D-E-R

We've all got to Raise our Sights!

THE year 1943 promises to be the grimmest, hardest year this country has ever faced. Every effort, and every dollar of national income not absolutely needed for existence, should go into war work and War Bonds.

In the Pay Roll Savings Plan, America finds a potent weapon for the winning of the war—and one of the soundest guarantees of the preservation of the American way of life!

Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. *Great as this sum is, it is not enough!* For the more dollars made available now, the fewer the lives laid down on the bloody roads to Berlin and Tokio!

You've undoubtedly got a Pay Roll Savings Plan in your own plant. But how long is it since you last checked up on its progress? *If it now shows only about 10% of the gross payroll going into War Bonds, it needs jacking up!*

This is a *continuing* effort—and it needs *continual* attention and *continual* stimulation to get fullest results.

You can well afford to give this matter your close personal attention! The actual case histories of thousands of plants prove that the successful working out of a Pay Roll Savings Plan gives labor and management a common interest that almost inevitably results in better mutual understanding and better labor relations.

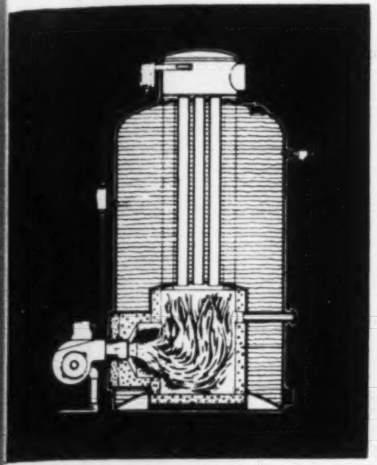
Minor misunderstandings and wage disputes become fewer. Production usually increases, and company spirit soars. And it goes without saying that workers with substantial savings are usually far more satisfied and more dependable.

And one thing more, these War Bonds are not only going to help win the war, they are also going to do much to close the dangerous inflationary gap, and help prevent post-war depression. The time and effort *you* now put in in selling War Bonds and teaching your workers to save, rather than to spend, will be richly repaid many times over—now and when the war is won.

You've done your bit Now do your best!

Hot bath and shaving water for the Army and Navy

Uncle Sam buys AQULUX WATER HEATERS



AQULUX
Heavy Duty
WATER HEATERS

Hot water builds military morale. Uncle Sam is supplying it as generously as possible at American camps and posts throughout the world.

It is a matter of pride to us that Johnson-built Aqulux Water Heaters have been chosen for so many of these government installations.

The exceptional performance and fuel-economy of Aqulux Heaters was a determining factor in their selection. Government procurement officers were guided by the *80% Efficiency Rating, the rapid recovery* and the *low operating costs* we have achieved in these unjacketed, uninsulated, ungalvanized wartime models.

Though virtually all of our capacity is being devoted to these government orders, we are endeavoring whenever possible, to take care of the needs of essential private industries.

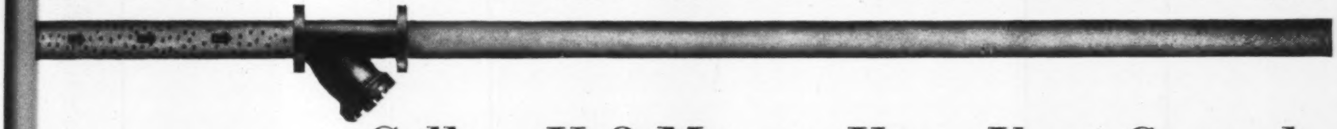
If you have a water-heating or oil-burner problem, we will gladly help you with all the manufacturing facilities and engineering experience at our disposal.

S. T. Johnson Co., 940 Arlington Ave., Oakland, Calif.,
and 401 No. Broad St., Philadelphia, Pa.

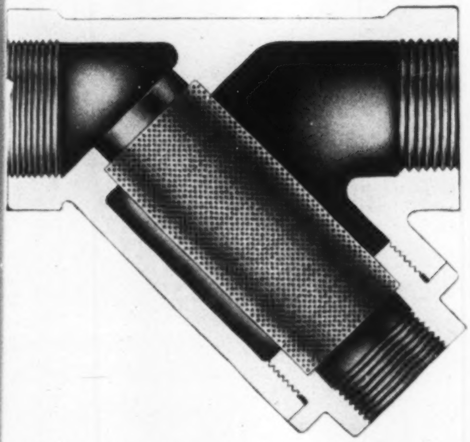
S. T. JOHNSON CO.

40 years of engineering and building fine Oil Burning Equipment

---



Call on K & M . . . *to Keep Your Control Equipment at Peak Efficiency!*



Our entire manufacturing output has gone to war . . . but 65 years of know-how is here to help you. If you have a pressure or fluid control problem—*any kind* of an installation, operating or maintenance problem—*call on K. & M.* Our new VALVE PROBLEMS CLINIC is a clearing house of information established to help keep your business going. There is no charge for this service. You needn't be using K. & M. equipment. But you have a job to do . . . and we want to *help* you do it, with specific, informative, resultful assistance.

K. & M. STRAINERS—"Y" and Basket Types for use on steam, water, gas, air, oil and other fluids. Note the oversized strained basket area to assure minimum pressure loss. Baskets are easily accessible for cleaning. These features are typical of the simplicity and efficiency of K. & M. design.

KM KIELEY MUELLER ESTABLISHED 1879

Kieley & Mueller
ENGINEERED PRESSURE & FLUID CONTROL SPECIALTIES
NORTH BERGEN, NEW JERSEY
Representatives in all Principal Cities

Propeller Fans

No. 4461—16 p. bulletin on propeller fans for ventilating public, industrial, and commercial buildings, describing four types which incorporate new features and include standard direct drive fans, high powered direct drive fans, and standard and high powered belt drive fans. A new nonmetallic panel contributing to quieter operation, longer service life, and easier installation is featured.—Autovent Fan & Blower Div., The Herman Nelson Corp., 1805-1827 N. Kostner Ave., Chicago, Ill.

Sheaves

No. 4462—16 p. bulletin (V-1400-B7C) on "QD" quick detachable sheaves for driver and driven units. Features are carefully described and illustrated, dimensions and other technical data are presented, and applications on numerous industrial V drives are indicated.—Worthington Pump & Machinery Corp., Harrison, N. J.

Spring Design

No. 4463—36 p. manual on spring design and engineering containing formulas for compression, extension, torsion, flat spiral or motor, flat springs, wire forms, etc., with illustrations, diagrams, and tables.—Mid-West Spring Mfg. Co., 4262 S. Western Ave., Chicago, Ill.

Steam Line Insulation

No. 4464—Folder describing the "'Z'crete" system for underground steam line insulation. This system comprises a structural concrete base, waterproofed on its top surface, on which precast "Zonolite" concrete blocks are placed to support the pipes until the "Zonolite" concrete is poured around the pipes. The pipes are wrapped with corrugated cardboard to provide a small cushion to take care of pipe expansion and movement. When the "Zonolite" concrete is set, forms are removed and exposed sections of concrete are waterproofed. Advantages of the method, construction views, and construction details are presented.—Universal Zonolite Insulation Co., 135 S. La Salle St., Chicago, Ill.

Steels

No. 4465—Technical data card (119A) giving a complete combined list of standard steels of the American Iron and Steel Institute and the Society of Automotive Engineers.—Babcock & Wilcox Tube Co., Beaver Falls, Pa.

Temperature Control for Buildings

No. 4466—Mailing piece emphasizing the need for outside type heating controls for apartment, office, and other large buildings in order to reduce fuel oil consumption and save coal. Approved in the interests of conservation of fuels by the Office of Price Administration, it is stated that every effort should be made to promote the use of such controls.—Marsh Tritrol Co., 600 S. Michigan Ave., Chicago, Ill.

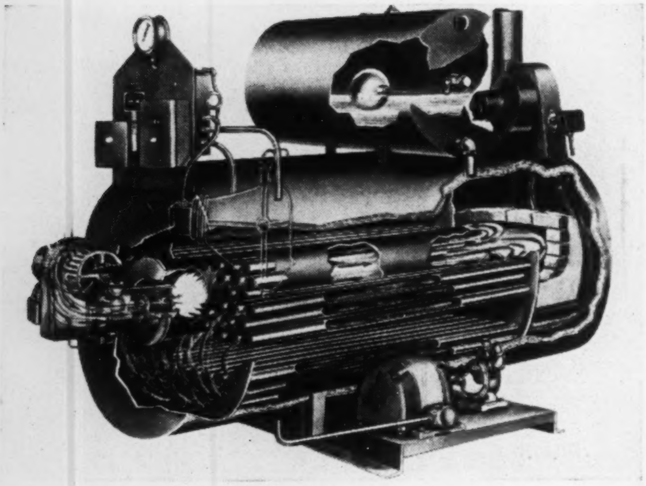
Tubes and Pipe

No. 4467—Technical data card (107B) giving a new revised list of standard specifications for seamless tube and pipe.—Babcock & Wilcox Tube Co., Beaver Falls, Pa.

Unit Heaters

No. 4468—Two new 2 p. specification sheets on the manufacturer's five way vertical discharge unit heater and the horizontal discharge unit heater, giving descriptions and illustrations of the units, steam ratings, dimensions, and Btu constants.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

The boiler that's going places
WITH THE U. S. NAVY!



Because it is
HIGHLY EFFICIENT! . . . SPEEDY!
COMPACT! . . . EASY TO CLEAN!

NEW O & S BOILERS are now helping to keep our Navy men spic and span — were designed by O & S engineers for use with portable laundry units at advanced Naval bases scattered over the world. This compact, fully automatic 15 H.P. Boiler develops 100 lbs. pressure from 60° water in 20 minutes . . . weighs only 2100 lbs. complete! Designed to utilize maximum BTUs for highest steam production.

Although developed expressly for mobile and portable use, the new Boiler promises wide application in your industry when Victory makes O & S Boilers again available for all purposes.

ORR & SEMBOWER INC.
READING • PENNSYLVANIA
O&S
Builders of Better Boilers
Since 1885

PETRO

REG. U. S. PAT. OFF.

Industrial and Commercial OIL BURNING SYSTEMS

are restricted—"for duration," to orders carrying high preference ratings.

Petro service, parts for necessary maintenance, and engineering consultation and services, are still fully available.

Petro Oil Burning Systems are meeting unprecedented steam demands in war production plants everywhere;

—24 hour operation, far above normal ratings, week after week;

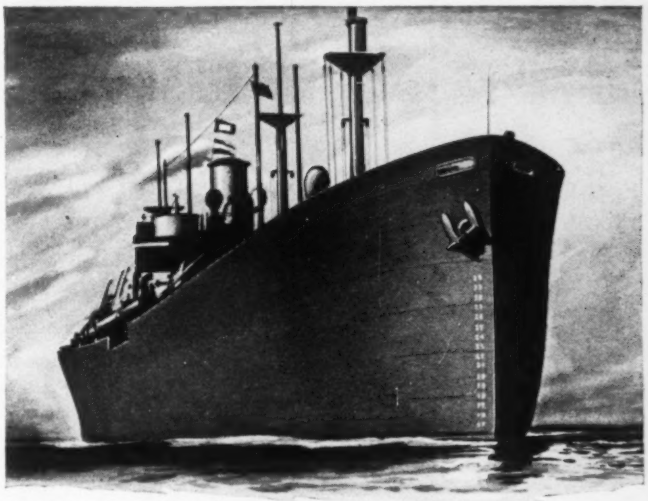
—a "break down" test on a gigantic scale which Petro Equipment is meeting efficiently, economically, reliably, and without breaking down because ample reserve strength and wear has always been built into Petro Systems.

In addition to being proud of such performance, we think it is a good thing for the heating trade to remember against the time when conditions again permit the free selection and installation of normal industrial and commercial firing equipment.

Our complete Industrial Catalog may be consulted in either SWEET's or DOMESTIC ENGINEERING Catalog Files—or copies will be sent gladly on request.

OIL IS AMMUNITION USE IT WISELY

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD CONNECTICUT



How W-T's* Speed Shipbuilding

Of all the amazing production records established by American Industry in meeting the needs of war, none are more amazing than those established by American Shipbuilders. And no where is there a greater need for strong, leakproof, trouble-free piping installations than in the vessels built to carry supplies to American Fighting Men and their Allies.

Many leading shipbuilders have adopted W-T's* as the standard fitting for making right-angle, branch pipe outlets. They've quickly recognized the man-hour savings these fittings make possible by eliminating templets, cutting and fitting the main pipe. They've been quick to recognize that the reinforcing features incorporated in the design of W-T's* make possible leakproof joints of full pipe strength . . . reduce vibrational stress . . . eliminate the necessity of extra braces . . . save material . . . reduce the weight of the system. They know the funnel-shaped intake aperture of W-T's* improves flow conditions . . . reduces turbulence and friction . . . increases operating efficiency.

Shipbuilders are not the only ones who recognize the advantages gained by using W-T's*. They have found ready acceptance in oil refineries, power plants, for refrigeration and air-conditioning systems, in pulp and paper mills, chemical plants . . . in fact, wherever piping is used . . . operating under a wide variety of conditions and a broad range of pressures and temperatures on all standard pipe sizes. Write for Bulletin WT-31.

3 Types Meet Every Need

Beveled outlet of WELDOLETS permit branch pipe to be attached with plain, circumferential, butt weld.

Threaded outlet of THREDOLETS permits branch pipe to be screwed into outlet of fitting.

Outlet of SOCKET-END WELDOLET is bored to accept standard outside pipe diameters. Junction is completed with weld around top of fitting.

All 3 types can be installed on the main pipe equally well with electric-arc or oxy-acetylene welding.

Branch Pipe Outlets
with
BONNEY
WELDOLETS
THREDOLETS
SOCKET-END
WELDOLETS

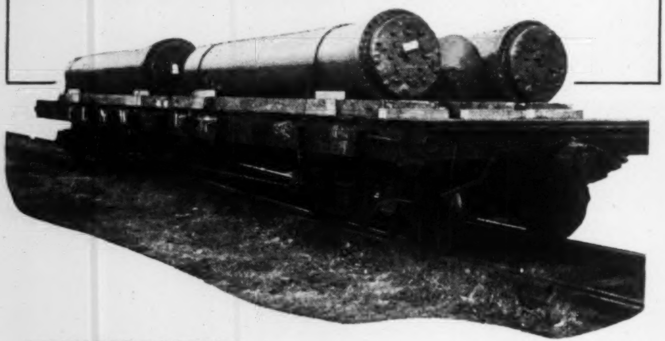
*WeldOlets.ThredOlets

Forged Fittings Division
BONNEY FORGE & TOOL WORKS, Allentown, Pa.

WELDOLETS· THREDOLETS
TRADE MARKS - REG. U. S. PAT. OFF.
Welded Outlets for Every Piping System

DESTINATION UNKNOWN

—but you can be sure it's a war plant!



READY FOR DELIVERY!
A carload of Freon Water Coolers, designed and constructed by Patterson-Kelley for an American war industry, standing on the siding at East Stroudsburg, Pa., preparatory to shipment.

SCARCELY a day goes by that carloads of Patterson-Kelley equipment doesn't leave our railroad sidings – bound for the nation's war plants or for Allied ports overseas.

With W.P.B. approval, you – and your clients – can still obtain Patterson-Kelley heat exchange equipment. And, in accordance with your priority ratings, it can be fabricated in a wide range of metals to meet your requirements. Or you can secure expert advice on the care and conservation of existing equipment – at no cost to you! Just drop us a line. Our engineers will be glad to help you obtain maximum, efficient service from all types of hot water installations and other heat exchange equipment.

PATTERSON-KELLEY FOR DEPENDABLE ECONOMICAL SERVICE

EST. 1880

THE Patterson-Kelley CO., INC
107 WARREN ST., EAST STROUDSBURG, PA.

Vacuum Pumps

No. 4469—4 p. bulletin (10) on "Schulz" bellows type vacuum pumps, offered for industrial and laboratory applications, with description of features and specifications. Capacities are 7, 12, and 15 cu ft at 4 in. mercury.—American Automatic Typewriter Co., 614 N. Carpenter St., Chicago, Ill.

Valves Under Limitation Order L-252

No. 4470—4 p. folder giving changes in construction of valves applying to the manufacturer's catalog 42 due to the WPB limitation order L-252 on valves. The bulletin represents the manufacturer's interpretation of the valves which he is permitted to manufacture under this order with notations of various changes in construction.—Fairbanks Co., 393 Lafayette St., New York, N. Y.

Welding and Cutting

No. 4471—20 p. handbook for welding and cutting operators, presenting suggestions in the interests of faster and higher quality production.—International Acetylene Association, 30 E. 42nd St., New York, N. Y.

Welding Electrodes

No. 4472—4 p. chart presenting a comparative index of welding electrodes aimed to simplify the buying of competitive products. It details the principal AWS and ASTM classifications and indicates which electrodes produced by 20 leading manufacturers meet the different requirements. —Air Reduction, 60 E. 42nd St., New York, N. Y.

Welding Electrode Stub Control

No. 4473—Reprint of 6 p. article presenting a simple plan for electrode stub control, by William E. Begor and David S. McLellan.—James F. Lincoln Arc Welding Foundation, Cleveland, Ohio.

Wood in the War Effort

No. 4474—Illustrated book discussing wood and its place in the war effort, available to companies engaged in war work.—Kay Displays, Inc., 9 E. 40th St., New York, N. Y.

New Refrigerating Data Book

With refrigeration playing an indispensable part in many war industries and in the essential preservation of food, a new publication of prime importance is the ASRE's Refrigerating Data Book. The new volume is the fifth edition of this basic work. The entire book has been revised and rewritten, this edition being a more complete treatment of the previous volume 1, devoted chiefly to refrigeration principles and machinery.

All chapters and data present practical information based on current practice; the latest refrigerant tables, for example, give the characteristics of commonly used refrigerants down to temperatures as low as —100° F. Theoretical explanations of the principles of refrigeration and air conditioning are presented with analyses, examples, problems, solutions, and illustrations. The text section covers 510 pp., while an advertisers' catalog and other sections cover 160 pp.

There are sections on refrigeration cycles, fundamental data, industrial systems, domestic-commercial systems, and air conditioning systems. Sold by the American Society of Refrigerating Engineers, 50 W. 40th St., New York, N. Y., the price is $4.00 in the U. S. and $4.50 elsewhere. Reduced prices are available for quantity orders.

★ BUY WAR BONDS ★

DIRECTHERM
UNIT HEATERS

squeeze the most out of coal, gas or oil. They utilize 80% of the fuel energy and distribute the heat evenly as far away as 200 feet.

Directherm Heaters solve many important war problems. They save metal, they save manpower, they save fuel. Installation is easy, no ducts, pipe, or radiators are needed. Automatic controls eliminate maintenance.

For coal, gas and oil. Made in 6 sizes (300,000-1,700,000 B.t.u.).

We also manufacture
all types of Steam Unit Heaters.

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. • ST. LOUIS, MO.

It's Time to Tell About Refrigeration's *"Hidden Services"*

.. *take* ICE CREAM *for instance*

Even a schoolboy, eating his Ice Cream Cone on a hot summer day, knows that Ice Cream and Refrigeration just naturally must stick together as long as possible.

But to the average consumer of this delightful food dessert, Refrigeration means—"hard" or "soft." He does not know that even slight variations of DEGREES of Refrigeration in the manufacturing processes may well determine the smoothness of texture, and even the rich flavor of the Ice Cream. Carefully CONTROLLED Refrigeration in "Mix" cooling and storage, the temperature of the "Mix" when drawing it off for packing, the time required for hardening, plus effective protection in storage, delivery and in Retail stores—all have their effect on the final quality—and popularity—of Ice Cream.

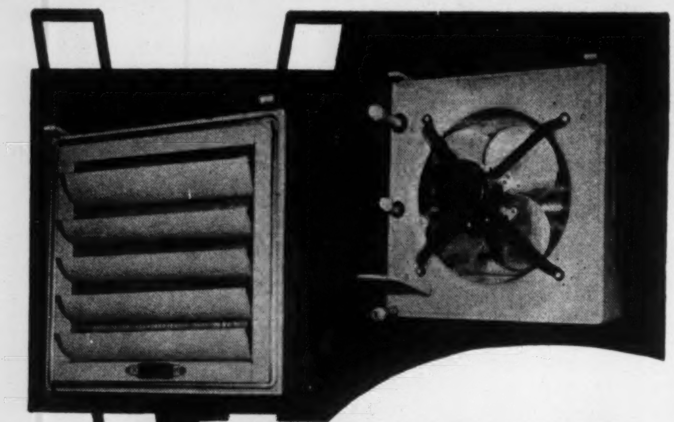
Helping maintain CONSTANT Refrigeration, at accurate and steady temperatures, for safe food processing and preservation, is one of the expected tasks of A-P DEPENDABLE Refrigerant Valves. Their proven ability to perform this task more effectively and economically is playing a vital role in keeping mechanical Refrigeration up to wartime peaks of efficiency with a minimum of service attention and replacement parts.

A-P Model 205— Used in Ice Cream hardening and Storage Units.

A-P Model 207— Popular in Ice Cream Processing, Trucks, Retail Cabinets.

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY — SECOND STREET
MILWAUKEE WISCONSIN
Export Dept. 100 Varick St., New York City

DEPENDABLE
Refrigerant Valves



KRAMER

Victory

COOLMASTER

NEW DESIGN FOR

QUICK DELIVERY

An all steel hot galvanized coil is used in the Victory Model Coolmaster. This line of units is designed to comply with the latest government limitations on critical materials. The number of models has been reduced to facilitate quick delivery.

OUTSTANDING FEATURES

Accurately rated. All ratings based on tests made in accordance with accepted standards and are guaranteed.

All steel spiral fin coil, hot galvanized after fabrication.

No welded or soldered return bends.

Can be used with Freon, Methyl, Sulphur, Ammonia, or Brine. Plaese specify if ammonia or brine will be used.

Heat interchanger is furnished.

One man suspension brackets for easier mounting.

Unusually pleasing in appearance. Finished in chrome gray shade of crackle; baked on a bonderized (rustproofed) base.

Silent, carefully balanced fans, direct connected to totally enclosed motors specially built for fan duty and long life.

Send for Bulletin R-143

KRAMER TRENTON CO.

Trenton, N.J.

Useful Information

General Metallography

To the already extensive literature on metallurgy and metallography has been contributed another work—an introductory text, General Metallography, by Ralph L. Dowdell, Henry S. Jerabek, Arthur C. Forsyth, and Carrie H. Green. One's first inclination would be to ask why there should be need for such a book at this time. The more one investigates the situation, and compares the material of this new book with what has previously been published, the more apparent it becomes that the book does serve an important purpose, and in a competent manner.

Primarily, works on metallography have been written for metallographers, or for advanced students specializing in the subject. Perhaps there were good reasons why this should be so. Undoubtedly, metallographers need many good books. But somehow it seems that the needs of another large group have escaped note or at least have failed to stimulate an adequate literature to aid them. That group includes the many industrial workers other than metallographers, who also deal with metals and who require scientific and technical information in a condensed and compressed form. The busy artisan or professional man seeking information on some practical point on metallography from the average scholarly work on the subject would too often encounter so formidable a presentation as to be dismayed of quickly finding what he wanted. If, on the other hand, he sought assistance from a handbook, he might find valuable data, but the danger of handbook data is that an inexperienced person might misinterpret or misapply them.

It would appear to be this middle ground between tome and handbook that these authors entered. They state their book to be, formally, a text for a one year course but suffi-

K-10
GENERAL CONTROLS

Six TIMES THE POWER

Multiply the ordinary solenoid valve by six and you get an idea of the powerful lever action developed by General Controls' K-10. This quiet, two-wire, current failure valve is easy to install on air-conditioning combustion or refrigeration equipment. K-10 handles air, gas, water, light and heavy oils, and steam. Positive opening and complete shut-off are assured. Designed for either normally closed or open. Available any voltage. A.C. or D.C. and up to 1¼" I.P.S., port sizes up to ⅝". For specifications write for Catalog

GENERAL CONTROLS

801 ALLEN AVENUE
Branches: Boston · New York
Philadelphia · Cleveland

GLENDALE, CALIFORNI
Detroit · Chicago · Dall
Denver · San Francisc

ciently concise for a shorter course. It certainly makes an excellent reference for the person who wants a simpler introduction to this extensive science.

The first four chapters present the fundamental physical and chemical concepts inherent to an understanding of metallography: elements, crystallization, alloy systems, and constitution diagrams. The reader versed in physical chemistry will enjoy this brief review; the one wanting in academic training will find it a useful and understandable summary of the preliminary information he must have. Then a short chapter explains the methods and apparatus of measuring high temperatures. The sixth chapter defines the mechanical properties of metals. Typical of the lucid and practical treatment is the section on fatigue or progressive failure of metals. The hazy and erroneous concept of the layman on failures due to "crystallization of the metal" is dispelled by simple explanation of why machine parts such as axles, spindles, and crankshafts can fail at stresses below their proportional limits and fail as though brittle when actual tests show the metal, to have high ductility. Chapter 7, Metallographic Control, discusses the need for and methods of preparing specimens for microscopic examination. Then a short chapter deals with the crystalline slippage and other intergranular changes occurring in cold working, plastic deformation and strain hardening.

GIVE
RED CROSS
WAR FUND

The longest chapter of the book, and composing one-third of it, is a condensed treatise on iron and steel. It considers pure iron, wrought iron, and steel as to their crystallography, composition, and types; presents a discussion of the iron-iron carbide (commonly called iron-carbon) constitution diagram; summarizes the art of heat treating; gives a concise treatment of alloy steels; and concludes with remarks on gray and malleable cast iron.

The next chapter similarly contains the metallography

To Speed Victory!
WE ARE READY TO SERVE YOU!
"American"
COLD PIPE, CONDUIT and TUBE BENDING MACHINES

Twelve types to select from. Hand operated capacities ¼ to 6" inclusive. Motor operated ¾ to 8" inclusive.

A few of our More Than 12,000 Customers:
Bureau of Ships, Wash., D. C.; Henry J. Kaiser Co., Calif.; Pacific Bridge Co.; Bethlehem-Hingham Shipyards; Hercules Powder Co.; Stone & Webster Engineering Corp.; E. I. Du Pont de Nemours & Co.; Louisiana Shipyards; Westinghouse Elec. & Mfg. Co.; General Motors Corp.; Crane Company.

Write Air Mail for printed matter.

"American"
PIPE BENDING MACHINE
Company INC

Quick Deliveries
51 PEARL ST.
BOSTON, MASS.

The Answer to
Simplified ... Faster Lower Cost
DY-NAMIC BALANCING
ONE OPERATION
SHOWS STATIC, DY-NAMIC and STATIC DY-NAMIC
ADJUSTABLE BED
PERMITS BALANCING OF MANY SIZES AND TYPES OF BODIES ON ONE MACHINE
MICROMETER DIALS
CALIBRATED TO SHOW APPROXIMATE QUANTITY OF CORRECTION

New BEAR Dy-Namic Balancing
Now making possible many Improvements In Production and Product Performance

Among the production and product performance improvements reported by leading manufacturers now using the new, lower cost, Bear Dy-Namic Balancing Machines are these:

IN PRODUCTION:
Less Time to Dy-Namically Balance to accuracy of government specifications... **no manpower problems**, as almost any man or woman can be trained as an operator in a few hours . . . **detection of errors in pattern designs**, leading to improvements in moulding . . .

IN PRODUCT PERFORMANCE:
Reduction in wear . . . elimination of noise and vibration . . . improved efficiency . . . reduction in frequency of adjustment or repair . . .

Bear machines utilize a new, entirely different principle for the dy-namic and static balancing of rotating bodies to remove the couple-force actions resulting from dy-namic unbalance. Not only does this principle eliminate the need for delicate, complicated mechanism but it makes possible Dy-Namic Balancing Machines which are faster, more accurate, easier-to-operate and MUCH LOWER IN PRICE.

WIRE, PHONE, WRITE details of your problems today, or write for FREE DATA BOOK describing the many Bear Machines available to those with war industry priorities. Address Bear Mfg. Co., Industrial Division, Dept. HPV, Rock Island, Ill.

BEAR
COMBINATION
STATIC AND DY-NAMIC BALANCING MACHINES

The REZNOR News
From Jelly Beans To Airplane Parts
STORAGE ROOMS BECOME WORKSHOPS

YOU'LL WANT THIS PAPER FOR 6 REASONS . . . . .

1 *Shows interesting unit heater installations*
2 *Tells how to maintain gas unit heater efficiency*
3 *Shows new products*
4 *Gives special news data*
5 *Jokes*
6 *Quick notes from trade papers*

We would like to put your name on our mailing list so you'll receive The Reznor News every month, gratis. You'll look forward to receiving this newsy folder... you won't miss an issue . . . it will stimulate you with pictures and news items of industrial achievements. Yes . . . we have beaten Time and Readers' Digest to success stories. The Reznor News is up-to-the-minute—no re-hash, no old stuff. If you are interested in heating, send the coupon, mail a card, or write a letter today.

REZNOR MANUFACTURING CO.
305 James St. Mercer, Penna.

GRATIS NOW

REZNOR MFG. CO.
MERCER, PENNA.
Gentlemen: Yes, you may send meThe News at no cost and no obligation.

Name ______________________

Address ______________________

City ______________ State ________

of nonferrous metals and alloys, including the very important brasses and bronzes; the so-called light metals—aluminum and magnesium; nickel and its alloys; and finally, bearing metal alloys. The concluding chapter is devoted to some notes on corrosion and protective coatings.

The designer and manufacturer of heating and air conditioning equipment will find the book to contain much information applicable to his business. It is noted, for instance, that the embrittlement of cold worked boiler steel of 0.18 to 0.24 per cent carbon, formerly termed caustic embrittlement, is now known to be intergranular corrosion caused not by pure caustic soda but by small amounts of many different salts acting on highly stressed metal, and that stress relieving anneal removes the embrittlement. The engineer responsible for specification or selection of metals to be used in marine practice will find data on suitable metals to withstand salt spray. For general application, those who fabricate metals or utilize things made of metal will gain from the book a knowledge of the characteristic properties of metal and how those properties may be most gainfully employed.

This is the first edition of this work. The publisher is John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. There are 292 + x pp., 6 x 9 in.; and the price is $3.25. —K. S.

Thermal Properties of Building Materials

[Summer Comfort Factors As Influenced by Thermal Properties of Building Materials, by C. O. Mackey and L. T. Wright, Jr., both of Cornell University. Published by the John B. Pierce Foundation, 40 W. 40th St., New York, N. Y. 27 pp., 8½ x 11 in.]

This rather complete study shows the effect of variations in daily temperature on the heat flow through walls and the effect of such variations in temperature and heat flow upon the conditions influencing comfort in an uncooled space. Mathematical methods have been developed for calculating the flow of heat through single layer walls of homogeneous materials when the temperature of the out-

CORK FOR ALL PURPOSES

NOW AVAILABLE

Corkboard and moulded cork pipe covering are now available without priority for air conditioning and other applications of low temperature. To obtain maximum power savings, use Mundet Cork Insulation. We shall be glad to help in the preparation of specifications. Mundet Cork Corporation, Insulation Division, 65 S. 11th St., Brooklyn, N. Y.

MUNDET
CORK INSULATION

CONSERVES LOW TEMPERATURE

side surface of the wall varies throughout the day as it does during the summer months. The authors have taken the very desirable step of reducing their formulas to a series of charts which make it possible to apply their methods to any particular wall to be studied. This is one of the valuable and outstanding parts of the paper.

Although the working method presented for solving problems is approximate, it is more than accurate enough for the usual conditions and it is reasonably simple. The method can be applied not only to variable air temperatures but also to determine the effect of sunshine falling upon a wall. The various charts presented enable the user to determine the maximum and minimum temperatures of the room side surface of a wall and the time at which these temperatures will occur. These charts should be of great value to those who are interested in figuring the refrigerating load of air conditioned spaces.

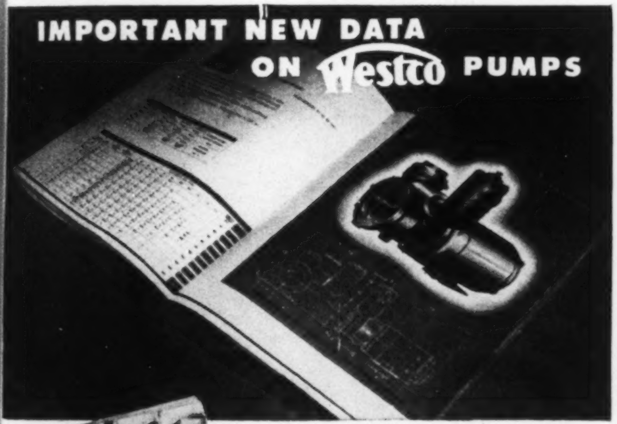
All in all, the authors are to be congratulated on this paper and the air conditioning industry owes a debt to the John B. Pierce Foundation for sponsoring this work and making the publication of this paper possible.

The text of this study was presented at an ASHVE meeting and published in the ASHVE Journal Section of the December, 1942, issue of HPAC.—W. G.

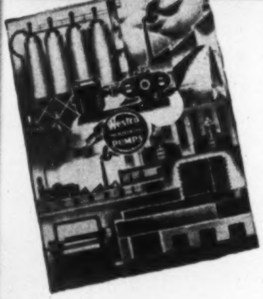
Revised Building Code

The Recommended Building Code of the National Board of Fire Underwriters, 85 John St., New York, N. Y., which serves as a model for building regulations in many cities throughout the country, has been revised to conform to advances in knowledge and experience which have resulted from new methods and materials, and to suggest means of protection required by new hazards.

The code does not attempt, however, to dictate choice of materials, assemblies, or designs so long as a proper degree of safety and health is attained. One of the principal reasons for this latitude is that new building materials and construction methods are constantly being developed and rigid requirements might retard their use.



IMPORTANT NEW DATA ON Westco PUMPS



SIXTY pages packed with vital new information on Westco Turbine Type Pumps . . .

- How the single Westco turbine gives *multi*-stage performance!
- How Westcos can be quickly renewed by simply renewing liners!
- Performance charts, tables, illustrations, installation layouts on Westcos for a wide range of applications!
- Pages of timesaving pump engineering data — conversion tables, head and pressure equivalents, friction-loss tables, etc.

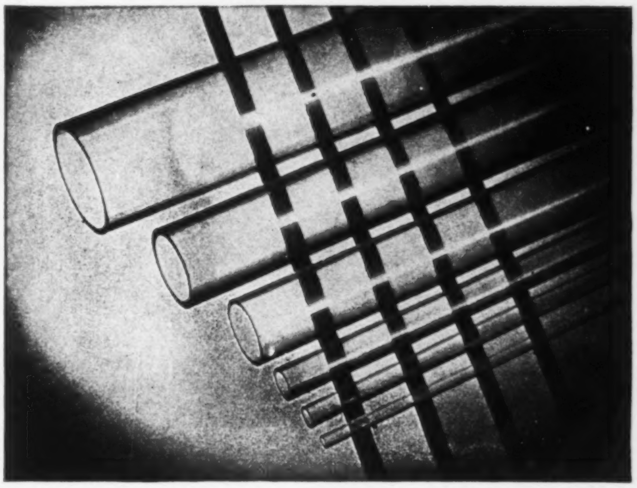
JUST OFF THE PRESS, this new Westco Catalog contains up-to-the-second data that should be in the files of EVERY pump user. Free copies are available as long as the limited supply lasts. Send for *your* copy TODAY!

JOSHUA HENDY IRON WORKS
POMONA PUMP CO. DIVISION
2621 LOCUST AVENUE, ST. LOUIS, MISSOURI

TULOX REG. U. S. PAT. OFF. **PLASTIC TUBING**

has many desirable properties including

TRANSPARENCY



Bands behind these TULOX Plastic Tubes prove their transparency!

Because it is made by our *exclusive* processes, TULOX Plastic Tubing possesses physical properties of timely interest. It is . . .

Made to close tolerances
Made from a number of different base resins
Available in wide range of sizes
Made in unlimited lengths
Light in weight
FREE OF STRAIN
TRANSPARENT

• • •

ALSO TULOX REG. U. S. PAT. OFF. **HOLLOW ROD**

MADE FROM TENITE II • HEXAGONAL • KNURLED • ROUND

• • •

SAVE CRITICAL MATERIALS! One pound of TULOX Plastic Tubing or Hollow Rod will replace approx. 8 lbs. of copper, block tin, stainless steel or 2½ lbs of aluminum or rubber. Every week, *somewhere*, a designer or production man "specifies TULOX" and releases more critical material for vital war production.

NATIONAL DISTRIBUTION. Immediate shipment from warehouse stocks for War Production. Illustrated catalog will be mailed on request.

EXTRUDED PLASTICS, Inc.
New Canaan Avenue Norwalk, Conn.

In Canada: Sole Licensees, **DUPLATE CANADA, LTD.**
Plastic Division, Oshawa, Ontario
Export Dept: AMERICAN STEEL EXPORT CO., INC.
347 Madison Avenue, New York, N.Y.

PERFORMANCE PLUS with Economy SCV Pumps

Economy's new vertical type pump for clear liquid services. Highly recommended for hot and cold water circulation, air conditioning systems, brine circulation, sprinkler equipment, boiler feeding, pressure boosting, etc.

- Vertical in design—saves floor space.
- Motor high and dry—away from splash and dirt.
- Complete rotor easily removed without disturbing piping connections.
- Impeller keyed to extra heavy shaft rotates between both an outboard and inboard bearing—smooth and noiseless operation.
- Built in sizes with discharges 1" to 3", for capacities from 10 to 500 GPM, with heads up to 225 feet.

Write for fully illustrated and complete descriptive Catalog No. D2-1042.

ECONOMY PUMPS, INC.
1011 WELLER AVENUE — HAMILTON, OHIO

WARNS WHEN AIR-FILTER CLOGS WITH DIRT

DIRT clogged filters in the air circulating system mean reduced efficiency and added power costs. On the other hand, changing filters oftener than necessary represents money wasted.

Install a Hays Air-Filter Gage and know exactly just how dirty and inefficient your filters are. An indicator shows the air resistance at all times. When the resistance becomes excessive an alarm is sounded or signal flashed. A high quality precision instrument by pioneer instrument makers. Write 990 Eighth Avenue, Michigan City, Indiana for special bulletin 37-278.

HAYS AIR-FILTER GAGE

TELLS CONDITION OF FILTER AT ALL TIMES

The HAYS CORPORATION
SINCE 1902
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

0 .1 .2 .3 .4 .5
HAYS

An outstanding addition to this 1943 code is an appendix in which the fire resistance rating, in hours of duration, is given for different forms of construction. This appendix covers walls and partitions, columns, beams, girders, trusses, and floor and roof construction. It was completed after months of study of all available data on tests made in this country and England. These results were analyzed so that the ratings given would be on a comparable and equitable basis.

This publication comprises 406 + x pp., 5 x 7½ in. and has a heavy paper cover.

New WPB Regulations Affecting Heating, Piping, and Air Conditioning

(Issued to May 20. Selected from listing compiled especially for Victory Bulletin, issued by the Office of War Information, by field contact branch of the War Production Board.)

Order L-38, amended. Industrial and commercial refrigerating and air conditioning machinery and equipment. 1. Removes restrictions on deliveries of repair parts for comfort cooling systems. 2. Heat exchangers and certain coils in food processing and packaging machines excluded from definition of systems. 3. Definitions and provisions of order are otherwise revised.

Order L-41, amended. Construction. Restates superseding clause to exclude L-41-d.

Order L-211, schedule 9. Oil country tubular goods. Restricts production, fabrication, and delivery to specified sizes and specifications.

Order L-211, schedule 10. Water well tubular products. Restricts production, fabrication, and delivery to specified sizes, dimensions, and weights.

Order L-217, schedule VII, amended. Pumps. Eliminates reference to A.G.C. in definition; corrects descriptive error on triplex road pump.

Order L-252, amended. Valves and valve parts. Deletes certain specifications of physical properties of steel in appendix to order.

Order L-268, amended. Oxyacetylene apparatus. 1. Redefines oxyacetylene apparatus as new device using oxygen with acetylene or other fuel gases to mold, heat or cut metals, or new acetylene generator. 2. Restrictions on acceptance and delivery of parts do not apply if apparatus cannot be effectively operated without repairs involved.

Order L-278. Steel pipe fittings; simplification. Limits manufacture to specified types, sizes, and specifications; prohibits manufacture of specified fittings.

Order M-9-c, amendment 1. Copper. Revises list A-2 and combined list.

Order M-9-c, amended. Corrected. Copper. Amends use and appeal restrictions; revises combined list, list A-2 and military exemption list.

Order M-41, amended. Chlorinated hydrocarbon solvents. Increases to 100 per cent of monthly consumption during year ended 9-30-41, quantity of solvents holder of B-2 rating may receive and to 150 per cent for carbon tetrachloride.

Order M-43-b, amended. Tin. Adds to exceptions to permit further use in repair of gas meters.

Order M-126, amendment 1. Iron and steel conservation. Eliminates conflict with L-142 (shutter type ventilators) and L-284 (luggage).

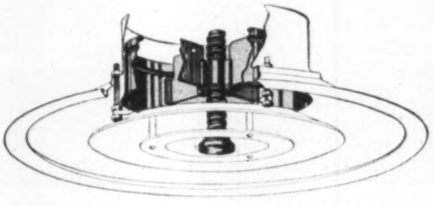
Order P-89, amended. Production of chemicals: maintenance, repair, operating supplies. Assigns AA-1 rating and allotment symbol for 2nd quarter, 1943; establishes application procedure for subsequent quarters; revises orders to conform with CMP regulation 5.

Order P-141-a. Public sanitation services—maintenance, repair, operating supplies. Permits sewage facilities to serve premises being constructed or remodeled under L-41, subject to certain provisions.

KNO-DRAFT K-NEWS

AIR VOLUME CONTROL IS IMPORTANT, TOO

The effectiveness of air diffusion and distribution is increased by air volume control at each individual outlet—especially when such volume control does not alter the diffusion characteristics.



Cutaway diagram of Kno-Draft Air Diffuser equipped with Type Dee Air Volume Control*
Patents Pending

A *plus* in efficient diffusion, KNO-DRAFT Type DEE Air Volume Control is furnished completely assembled within the diffuser—adjusted and ready to operate. Descriptive Folder-H on request.

**Formerly known as Dorex Kno-Draft Air Diffuser*

WB CONNOR ENGINEERING CORP.

W. B. CONNOR ENGINEERING CORP.
114 East 32nd Street New York, N. Y.

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

NoDrip A SURE CURE

● This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition surfaces. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance. A gallon covers about 30 feet of ½" pipe. Dries in 24 hours. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House.

FREE *NoDrip Handbook. All about Condensation Drip and its Prevention.*

APPLY WITH BRUSH, TROWEL OR SPRAY

J. W. MORTELL CO.
Technical Coatings Since 1895
512 BURCH ST. KANKAKEE, ILL.

LOW COST INSURANCE

FOR EXPENSIVE EQUIPMENT

SARCO STRAINER

Clean liquids never clogged a pipe line, or caused delicate control and valve mechanisms to slow up.

Put a Sarco strainer in your lines ahead of every trap, valve, pump, burner or lubricator. This insurance costs nothing once installed.

Sizes range from ¼" up to 8" for all commercial pressures with screens for steam, water, oil, brine, ammonia and other fluids.

Order an assortment and put them in the line at the points where dirt, scale or other impurities cause shutdowns. They cost little, are easy to install and cleaned in a jiffy by blowing through. Ask for Catalog No. 1200.

161

SARCO SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
Sarco Canada Ltd., Federal Bldg., Toronto, Ont.

GREEN LIGHT FOR INDUSTRY

*SARAN PLASTIC PIPE, TUBING, FITTINGS

SARAN by HODGMAN is a tough thermoplastic specially made to replace strategic materials. It is adaptable for use under high working and bursting pressures and is resistant to most chemicals. Its ease of handling makes it extremely valuable in installations requiring the transport of oil, gas and corrosive chemicals.

*Pat. No. 2160931

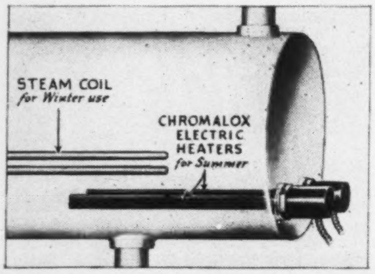
Send FOR COMPLETE INFORMATION SHEET AND FREE SAMPLE

HODGMAN RUBBER CO.
FRAMINGHAM, MASS.
NEW YORK 261 Fifth Avenue
CHICAGO 412 South Wells St.
SAN FRANCISCO 121 Second St.

Get hot water or process steam electrically-*and shut down boilers*

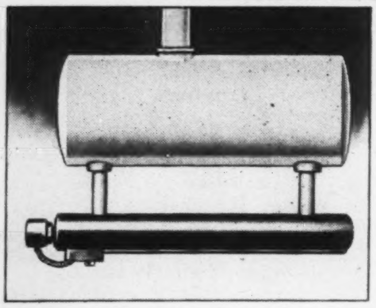
For Summer Hot Water

This tank is heated by two 4 kw. Chromalox electric immersion heaters. Installed by screwing in threaded bosses welded to the tank wall. For winter, when steam is available, a steam coil is inserted. This arrangement eliminates costly summer steam boiler operation.



For Summer Process Steam

Use a simple electric steam generator. Heated by Chromalox Unit which comes complete with piping, insulation, thermostat control, etc., ready to hook up with small boiler. Less wasted heat, greater comfort for operators, lowered cost, no piping problems—and big main boiler can be shut down.



CHROMALOX
ELECTRIC HEATING UNITS

Use the expert aid of our engineering department. Tell us your problem. Catalog on request.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. **Pittsburgh, Pa.**

THIS IS THE STOKER THAT WON ITS FAME ON *INDUSTRIAL* JOBS!

★ Simple mechanically . . . the Frederick Stoker is especially rough-tough-and-rugged in construction . . . Was designed first and primarily to withstand the rigors of heavy-duty industrial installations. And, among the several Frederick models, you'll find a Frederick Stoker that is designed for your needs—with a long success record on similar jobs. Ask about it; no obligation.

HOPPER or BIN FEED
200 to 850 LBS. PER HOUR
Clinker type, or Side Dumping Grate; Hopper or Bin Feed models.

FREDERICK
INDUSTRIAL STOKERS

The FREDERICK IRON & STEEL CO.
East Seventh St., Frederick, Maryland

Centrifugal Pumps for All Purposes

Coming Events

Smoke Prevention

Smoke Prevention Association: 37th annual meeting, June 8-11, Hotel William Penn, Pittsburgh, Pa. The program includes papers on probability of error in sampling coal, by Henry F. Hebley, Pittsburgh Coal Co.; smoke tendencies of coals, by H. J. Rose, Mellon Institute of Industrial Research; smoke from the viewpoint of the chemist, by E. Berl, Carnegie Institute of Technology; collection of fly ash from spreader stokers, by K. H. Bowman, Dravo Corp.; analysis of fly ash, by H. C. Dohrman, Buell Engineering Co.; design and application of overfire air jets, by R. B. Engdahl, Battelle Memorial Institute; overfire air performance applied to stationary plants, by Harry Carroll, Commercial Testing and Engineering Co.; application of overfire air and its relation to the smokeless operation of locomotives, by E. D. Benton, Louisville & Nashville R. R. Co.; review of surveys of heating and power plants made in various cities with recommendations for the elimination of smoke, by Carroll F. Hardy, Coal Producers Committee for Smoke Abatement; burning wood waste in power plant boiler furnaces, by B. H. Whitehouse; petroleum industry's viewpoint of the fuel situation, by R. J. Boyink; wartime fuel conservation, by K. C. Richmond; present and future fuel oil outlook, and oil to coal conversion, by A. B. Wolle; dust fall survey, by Ernest Brundage; railroad smoke prevention by Samuel A. Dickson; and railroad smoke control in Pittsburgh, by W. H. Kimberly, Pittsburgh Bureau of Smoke Prevention.

District Heating

National District Heating Association: 34th annual meeting, June 9-10, Hotel Schenley, Pittsburgh, Pa. This is to be a "strictly technical meeting devoted to wartime problems of steam utilities." Among the papers scheduled, in addition to committee reports, are heat consumption of the two research committee typical buildings, by F. Lee Rapson; hot water consumption of buildings, by Albert F. Metzger; changes in hot water and steam use due to the war; wartime commercial activities of utility members, by George H. Tuttle; results of 59 automatic temperature control installations, by Mr. Tuttle; meter maintenance problems due to difficulty of obtaining critical materials, by R. H. Brown; testing condensate meters by testing drums only, by J. C. Butler; methods and materials used in cleaning meter drums, by R. J. Bodin; progress report on weather statistics, by John F. Collins, Jr.; the chemistry involved in some unusual cases of steam and condensate, by Louis Shnidman; mechanism of the dissolution of carbon dioxide in steam heating equipment, and activities of the American coordinating committee on corrosion, both by Leo F. Collins; wartime practice in materials and equipment, by A. A. Sellke; safety rules for district steam system operation, by Dwight L. McNulty; damage to insulation by flooding, by W. W. Stevenson; and methods of protecting materials in manholes, by Paul Chenzoff. Secretary-treasurer of the NDHA is John F. Collins, Jr., 827 N. Euclid Ave., Pittsburgh, Pa.

Building Owners and Managers

National Association of Building Owners and Managers: 36th annual convention, June 21-24, Saint Paul Hotel, St. Paul, Minn. Wartime problems and government regulations affecting large commercial properties will be featured. There will also be an operating methods and equipment exhibit. Assistant secretary of the NABOM is W. J. McLaughlin, 134 S. La Salle St., Chicago, Ill.

Testing Materials

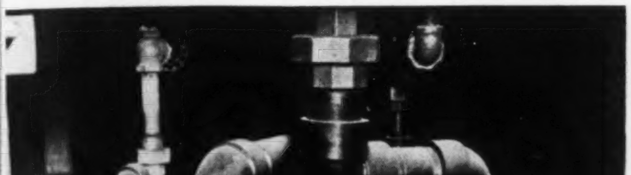
American Society for Testing Materials: 46th annual meeting, June 28-July 12, Hotel William Penn, Pittsburgh, Pa. Headquarters office of the ASTM is at 260 S. Broad St., Philadelphia, Pa.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1943, Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.

Plastic Piping for Process Use

No. 2454—Produced by modified extrusion, "Saran" (thermoplastic) pipe has a smooth, cylindrical shape resembling in appearance metal pipe of comparable dimensions. This pipe possesses a range of distinctive properties such as toughness, durability, long life, and a high degree of chemical, corrosive, and scale resistance, says the maker, who states that these properties make it of inestimable value to electrical, oil, gas, water, and chemical processing industries.



One of the newest and most interesting electrical applications for this pipe is the installation of nearly 4000 ft on heat exchangers and rectifying units in the rectifier stations at a new Dow Magnesium Corp. plant. Mass production of magnesium metal by the electrolytic method requires an abundance of power. Each of scores of cells must be supplied with direct current to electrolyze the magnesium chloride feed and produce molten metal. It is here that the rectifiers come to the fore. The rectifying station, housing 12 rectifiers and a corresponding number of heat exchangers, is the nucleus of power distribution for each magnesium cell building. The photo shows piping connections to a rectifier.

It is the purpose of the rectifier to convert electricity from alternating current to direct current. Power for the plant is supplied at a potential of 120,000 volts of alternating current. The voltage is stepped down by a group of outside transformers to 13,800 volts of alternating current before it is eventually conducted to the rectifying station where conversion to a constant flow of 600 volts of direct current takes place.

In the process of rectification from 13,800 volts a-c to 600 volts d-c, certain power losses occur in the form of heat. The heat is absorbed by water in jackets on each of the several rectifier units and is carried by means of a closed circuit water circulating system to the heat exchangers on the floor below by means of the plastic pipe. Water from a river is used in the heat exchangers to pick up the heat and carry it away. The excellent electrical insulation of the pipe prevents the 600 volt potential of the rectifier water jackets from being grounded through the heat exchangers to the river water piping system. The water flows from the rectifier jackets to the heat exchangers at temperatures varying from 140 F to 160 F, and returns at approximately 85 F.

The pipe's resistance to the ravages of corrosion prevents scaling or fouling in the rectifier jackets. The scaling or fouling of jackets necessitates dismantling of the whole rectifier to locate the trouble.—Dow Chemical Co., Midland, Mich.

Fuel Economy with Unit Ventilators

No. 2455—A possibility of preparing to economize on fuel in the light of expected stringencies during the coming heating season is suggested to users of unit ventilators by Albert J. Nesbitt.

There is probably no other place in many heating and ventilating systems where as much economy can be effected without impairing the efficiency of the system as in the ventilating equipment, especially if it be equipment that is now introducing large quantities of outdoor air, and equipment that lends itself to being converted to mixing indoor and outdoor air, he says. Partial recirculation of air during periods of occupancy is a widely accepted and approved practice. This is no longer a controversial point. Where the full quantity of air handled by the heating and ventilating system is taken from outdoors, he estimates that two-thirds of the total fuel consumption is required for ventilation. It therefore follows that any reduction in the outdoor air introduced will effect an economy in direct relation to the percentage of indoor and outdoor air that is being mixed.

Widely accepted practice is to reduce the minimum quantity of outdoor air to one-third of the total air in circulation, thereby recirculating two-thirds of the total air quantity. The savings thus effected are in the order of two-thirds of the ventilation load (as indicated above, this is two-thirds of the total load) or some 44 per cent of the total fuel requirements.

It is not sufficient merely to reduce the quantity of outdoor air and to add recirculated air to the total volume in an amount equal to the amount of the outside air reduction so as to maintain the same total quantity, accord-

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [7-43]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature.

(Circle each number in which you are interested):

2454	2455	2456	2457	2458	2459	2460	2461	2462	2463
2464	2465								
4475	4476	4477	4478	4479	4480	4481	4482	4483	4484
4485	4486	4487	4488	4489	4490	4491	4492	4493	4494

Name........................... Title.............

Company ....

Address ....

City............................. State...........

WHAT ARE *you* DOING ABOUT POST-WAR PLANNING?

Practical, well-laid post-war plans are the immediate need of all industry. Many important new developments, applied through intelligent planning, will bring new efficiency and comfort to a world at peace.

If dependable temperature or pressure control is a factor in the successful application of your product or service, it will pay you to investigate the White-Rodgers Hydraulic-Action principle and other new developments in temperature and pressure control.

Because of the importance of post-war plans to American industry, we have prepared a "Post-War Planning Checklist" which may be of assistance in setting up your own post-war program. We shall be glad to send you a copy upon request.

HYDRAULIC ACTION CONTROL

WHITE-RODGERS ELECTRIC CO.
1205G CASS AVE. ST. LOUIS, MISSOURI

ing to Mr. Nesbitt. To do this alone would reduce the cooling power of the ventilation system. In order to take advantage of the economy that comes from mixing indoor and outdoor air, it is desirable to provide automatic means of increasing the quantity of outdoor air above the minimum and simultaneously decreasing the quantity of recirculated air. Controlling the quantity of outdoor air by having a fixed minimum, without a limit on the maximum up to the full quantity that the system is capable of handling, is referred to as a thermal system of ventilation control.

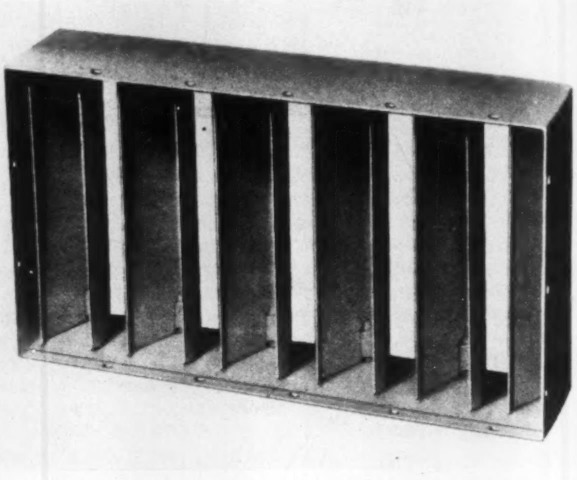
"Syncretizers" are provided with inlet and recirculating dampers which may be adjusted readily to mix indoor and outdoor air in the desired quantity within the limits of the capacity of the ventilating unit. While many of these units are already operating on the thermal system of ventilation control by which the maximum fuel economy is being obtained, there are undoubtedly many users who are still operating the units to introduce their full capacity of air from outdoors without taking advantage of mixing indoor and outdoor air.

For those using the equipment in this way, there is an opportunity to effect fuel savings of the order indicated above. This requires an adjustment in the automatic temperature control at the unit ventilator so as to cause the damper of the unit ventilator to be set for a fixed minimum quantity of outdoor air when the unit is operating on the heating cycle. Larger quantities of outdoor air are mixed with smaller quantities of room air when the unit is operating on the cooling cycle.

It should be noted that the ideal thermal system of ventilation control is one in which no more than the minimum quantity of outdoor air is introduced, so long as the air is being warmed, and only after all sources of heat have been shut off does such a system introduce an increasing quantity of air from outdoors.—John J. Nesbitt, Inc., State Rd. and Rhawn St., Philadelphia, Pa.

Adjustable Control of Air Distribution

No. 2456—The "Volocitrol" has been designed to provide noiselessly positive and adjustable control of air volume, pressure, and distribution across a supply outlet. It supplants splitters, volume dampers, and similar devices in balancing of air distribution systems, says the maker.



The frame of the device is of 16 ga steel 2⅛ in. wide. The pivoted louvers are of 24 ga steel. Friction pins on each louver allow it to be set by hand and positions are maintained when once set.

A fireproofed felt edging strip to fit between the frame and the duct is furnished as standard.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

Steam Jacketed Strainers

No. 2457—A new strainer for handling highly viscous liquids or liquids that are solid at room temperatures has been announced. An addition to the "Ezy-Kleen" line, these steam jacketed strainers are used to maintain the liquid

Neglect is Sabotage

Check fuel leaks in your heating system...

In thousands of heating systems—very possibly yours—there are hidden fuel leaks. You can't see them because they aren't signalled by hissing steam or pools of water. Dirty boilers, worn valves, poorly functioning traps, leaky flanges, water pockets in sagging pipe lines, clogged strainers, pumps that need adjusting, these are unseen but they drain away fuel. Neglect of proper maintenance and operation is akin to sabotage of our National war economy.

The Dunham Organization is dedicated to the principle of "Efficiency *with* economy in heating". We will be glad to counsel with you on tuning up your heating system so that it will make a patriotic contribution to National Security next winter by saving fuel.

Dunham Differential Heating stretches the heat values of steam and advances fuel economies far beyond ordinary concepts. We will gladly send details. Just write to our Chicago office.

DUNHAM
DIFFERENTIAL
HEATING
MAKES FUELS
GO FURTHER

C. A. DUNHAM COMPANY
450 E. OHIO ST. • CHICAGO
TORONTO, CAN. **LONDON, ENG.**

Young
STREAMAIRE

AIR CONDITIONING
FOR VITAL WARTIME NEEDS

Control of temperature, humidity and air circulation for precision production, food preservation and health maintenance is a war-time requirement. So important is this need that Government Agencies will grant priorities for air conditioning equipment to control these factors. Young STREAMAIRE air conditioning units provide the essential elements necessary for proper air treatment, in a completely engineered and tested arrangement. Consult with Young engineers on your specific problem.

YOUNG RADIATOR COMPANY
DEPT. 113-G RACINE, WIS., U. S. A.

PRECISION PRODUCTION —The need for air conditioning in the manufacture of essential precision instruments, tools or products is recognized as a necessity of tolerance control. It is also approved for the maintenance of workers' health where conditions of unavoidable heat or contamination of air exist.

FOOD PRESERVATION —Air conditioning equipment for handling, sorting and storage rooms, when essential to maintaining the edibility and nourishment content of food will be permitted. Such equipment is particularly valuable in the preparation for processing by dehydration and quick freeze methods.

HOSPITALS and LABORATORIES —Specific authorization is given for air conditioning equipment for research, testing and analytical laboratories; for hospital rooms used for surgical operations, X-ray or critical convalescent treatment: and for the production and storage of drugs and biological products.

YOUNG *STREAMAIRE* air conditioning units are made in eight horizontal and eight vertical models, with capacities ranging from 400 to 16,625 cfm . . . built for top performance in every size and type of installation. For cooling, heating and air conditioning.

BUY BONDS—PRODUCE MORE
SALVAGE SCRAP—WIN THE WAR

Young
PRODUCT OF Young ENGINEERING AND MANUFACTURING SERVICE SPECIALIZING IN HEAT TRANSFER PRODUCTS

HEAT TRANSFER PRODUCTS
OIL COOLERS • GAS, GASOLINE, DIESEL ENGINE COOLING RADIATORS • INTERCOOLERS • HEAT EXCHANGERS • ENGINE JACKET WATER COOLERS • UNIT HEATERS • CONVECTORS • CONDENSORS • EVAPORATORS • AIR CONDITIONING UNITS • HEATING COILS • COOLING COILS

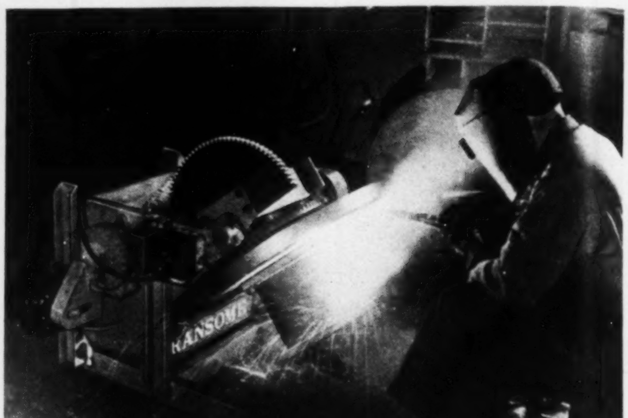
in the strainer at the same temperature as in the piping. The bottom and sides of the unit are completely enclosed in a steam jacket and two inlet and two outlet ports are provided for steam line connection.

Standard capacities are 20, 50, 100, and 200 gpm and pipe sizes are 1, 2, and 3 in. Maximum operating pressure is 50 psi at 600 F and the jacket is suitable for 125 psi steam pressure, the maker states. — Blackmer Pump Co., 1920A Century Ave., S. W., Grand Rapids, Mich.

Welding Positioners

No. 2458—A new welding positioner is designed to handle loads up to 500 lb with the center of gravity of the load 6 in. away from the table top and with a 6 in. eccentricity.

The positioners are available in hand or motor operated models. The motorized unit includes a "Reeves" variable speed drive providing a speed range of up to 1 rpm of the table top. Tilting range is a full 135 deg from horizontal or 45 deg beyond vertical providing the "down under" position for all downhand welds.—Ransome Machinery Co., Dunellen, N. J.

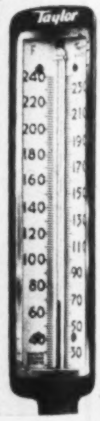


Industrial Thermometer

No. 2459—A new one piece industrial thermometer has been designed to save critical metals, says the manufacturer.

The one piece case is shallower which makes it possible to see the mercury column through a wider angle of vision. The chromium plated bezel fits snugly into the grooved case in such a way as to hold the thick glass front securely against four wavy tension springs. These springs are fastened securely under the scale by shakeproof screws. This construction results in a dustproof, rattleproof, and practically fumeproof thermometer which can withstand vibration and severe shocks.

These instruments are furnished in many combinations of straight and angle stems, with threaded or union connections, and in many standard temperature ranges, within the limits of —40 F to +750 F.—Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.

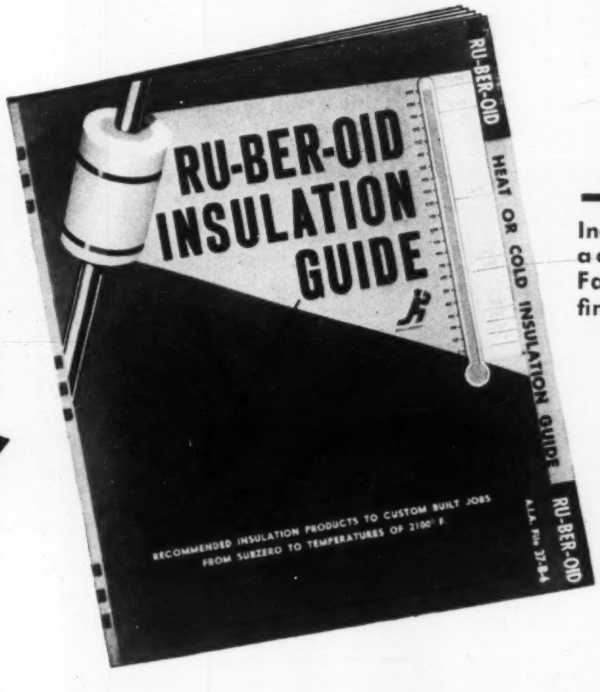


Purchases Tubing Company

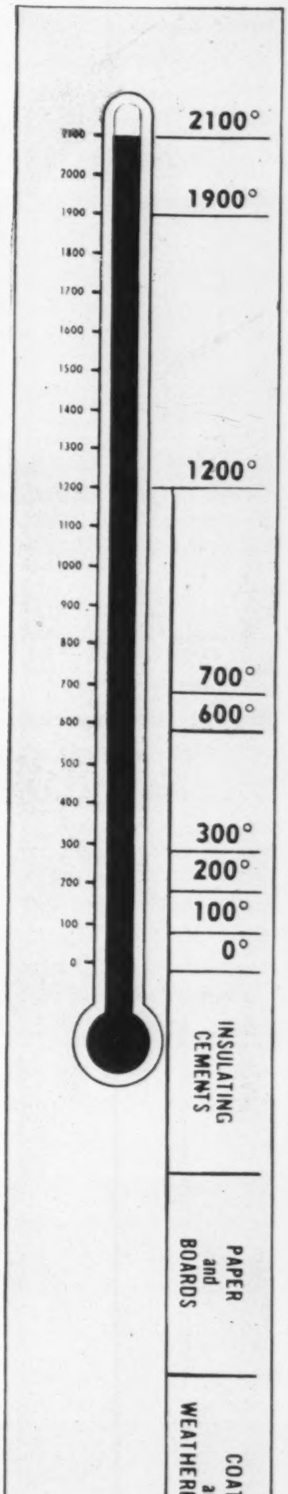
No. 2460**—Talon, Inc., Meadville, Pa., makers of slide fasteners, recently purchased controlling interest in the stock of Electroweld Steel Corp., Oil City, Pa., manufacturer of pressure and mechanical steel tubing. No product changes are anticipated.

This tubing is manufactured of strip steel which is accurately formed and welded, and meets the demands for boiler, condenser, heat exchanger, and mechanical applications. Production is geared entirely to the manufacture of pressure tubing for the armed forces.

ASK FOR IT→


RU-BER-OID INSULATION GUIDE
RU-BER-OID
HEAT OR COLD INSULATION GUIDE
RECOMMENDED INSULATION PRODUCTS TO CUSTOM BUILT JOBS FROM SUBZERO TO TEMPERATURES OF 2100° F.
RU-BER-OID
A.I.A. File 37-B-4

Index to guide, actual size. Facts at your finger tip.


2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
2100°
1900°
1200°
700°
600°
300°
200°
100°
0°
INSULATING CEMENTS
PAPER and BOARDS
COATINGS and WEATHERPROOFINGS
TECHNICAL DATA

Valuable at all times . . .
ESSENTIAL IN WARTIME!
adequate answers to your insulation problems

. . SHORTAGES! PRIORITIES! AVAILABILITIES!

Side-indexed to give you, in seconds, the Ruberoid Thermal Insulation best suited to *your* needs! This book is meaty, factual —complete with informative charts and tables. A few minutes' reading familiarizes you with the full line of Ruberoid Insulations, the temperatures and conditions which they serve. Between its covers, too, is real help—quick—in solving many war-created problems affecting insulation.

FREE to engineers and executives upon request. Just say: "Send me your Ruberoid Insulation Guide." Address:—

The RUBEROID Co.
Executive Offices, 500 Fifth Avenue
New York 18, N. Y. Dept. HP7

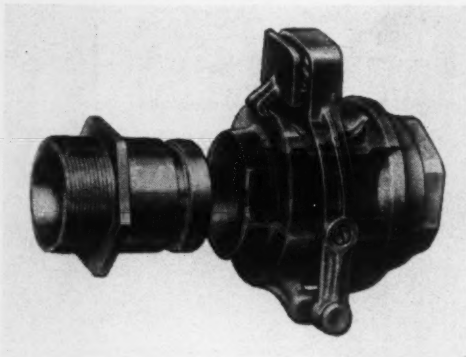
The Ruberoid Insulation System covers every vital phase—the right *Materials* for the job; the right *Men* to do it; and the right *Methods*. You get all three with Ruberoid Thermal Insulation.

MATERIALS, MEN, METHODS—*all 3 with*

RU-BER-OID
THERMAL INSULATIONS

Quick Disconnect Couplings

No. 2461**—New applications of quick disconnect couplings are constantly being made by industrial designers, engineers, and technicians in the handling of all fluids, including compressed air and vacuum, says the maker.



These industrial and marine couplings are disengaged by releasing a latch and throwing a lever. Connection is made by placing the two ends of the coupling together and raising a lever. Sizes ¾ to 2 in. are die cast and larger sizes are machined from brass or aluminum.

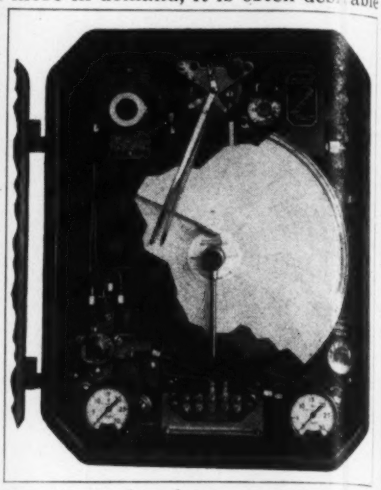
A special line of these couplings, including single and double self sealing models as well as the open type, is manufactured primarily for the aircraft industry but also is used in special marine and industrial applications.—E. B. Wiggins Oil Tool Co., Inc., 3424 E. Olympic Blvd., Los Angeles, Calif.

Flux for Wartime Solder

No. 2462**—A new flux designed especially to work with solder of low tin and high lead content has been developed. According to the manufacturer, such solder flows easily and evenly, creating a strong bond, when this flux is used. Because it works well with most metals the flux eliminates the necessity of using several types.—Paul-Lewis Laboratories, Inc., 924 N. Fourth St., Milwaukee, Wis.

Automatic-Manual Unit for Process Control

No. 2463—Although automatic control for continuous processing is more and more in demand, it is often desirable to exercise manual control. On many applications it is more convenient to start up a continuous process on manual control and switch to automatic as it becomes stabilized. Expensive standby equipment may be avoided and costly process interruptions may be eliminated if convenient manual control is possible for checking, inspecting, or repairing of instruments.

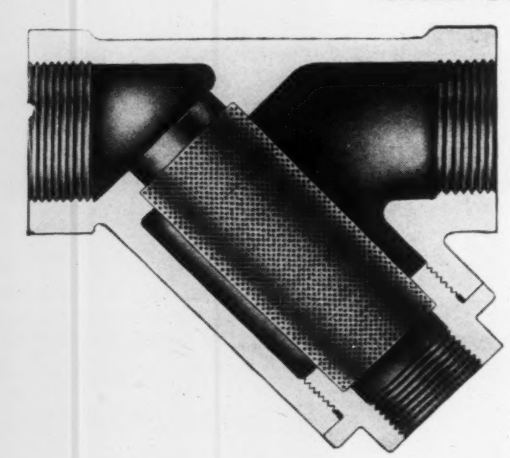


A new automatic-manual control unit with a number of improvements has been announced. In addition to the three usual positions, "automatic," "manual," and "service," it contains a fourth step, "test." When it is set at "test," the control is manual but the full 20 psi supply pressure is applied to the instrument mechanism to make possible its complete and accurate readjustment without disturbing the position of the controlled diaphragm valve.

The new unit is designed to be installed entirely within the case of a "Fulscope" single duty recorder controller.—Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.

Plastic Reducing Couplings

No. 2464**—A new "Saran" plastic reducing coupling is an adaptation of the union coupling and has the same char-



Call on K & M . . . *to Keep Your Control Equipment at Peak Efficiency!*

Our entire manufacturing output has gone to war . . . but 65 years of know-how is here to help you. If you have a pressure or fluid control problem—*any kind* of an installation, operating or maintenance problem—*call on K. & M.* Our new VALVE PROBLEMS CLINIC is a clearing house of information established to help keep your business going. There is no charge for this service. You needn't be using K. & M. equipment. But you have a job to do . . . and we want to *help* you do it, with specific, informative, resultful assistance.

K. & M. STRAINERS—"Y" and Basket Types for use on steam, water, gas, air, oil and other fluids. Note the oversized strained basket area to assure minimum pressure loss. Baskets are easily accessible for cleaning. These features are typical of the simplicity and efficiency of K. & M. design.

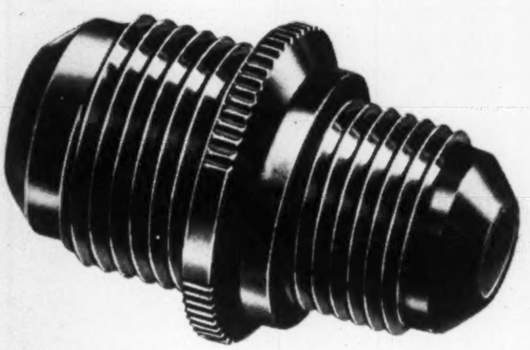
KM KIELEY MUELLER ESTABLISHED 1879

Kieley & Mueller

ENGINEERED PRESSURE & FLUID CONTROL SPECIALTIES

NORTH BERGEN, NEW JERSEY

Representatives in all Principal Cities

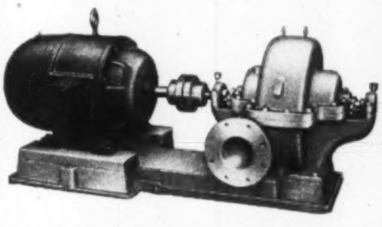


acteristics of strength, performance, and life. It is available with ⅛ in. reduction for all sizes of this tubing from ¾ in. to ⅛ in.

These reducing couplings are available now subject to special order.—Commercial Plastics Co., 201 N. Wells St., Chicago, Ill.

Centrifugal Pumps

No. 2465—An improved line of type "AD" two stage, horizontally split case, centrifugal pumps, in capacities up to 600 gpm and heads to 400 ft, features streamlined water passages and impellers, both hydraulically coordinated to minimize flow resistance.



The new pumps are compact and are readily accessible due to the removability of the upper half of the pump casing without disturbing the suction or discharge connections the maker says. These pumps are adaptable to a wide variety of services and are recommended for use in general water supply for municipalities, industrial establishments, office buildings, etc., and for handling condenser circulating water, wash water, liquids in paper mills and distilleries, chemical solutions, petroleum liquids, irrigation, etc.

A new line of type "G. M. C." close coupled centrifugal pumps designed for many services, notably marine duties, where compactness is at a premium has also been announced. These pumps are available in a capacity range of from 5 to 1000 gpm for operation against heads up to 100 psi.—Aurora Pump Co., 619 Loucks St., Aurora, Ill.

WHAT SHALL WE CALL IT?

The Editor—

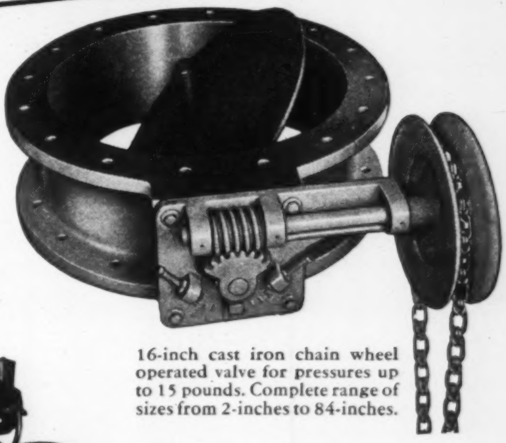
Having been connected with the early developing and marketing of convectors, I remember very well the confusion that existed because of the fact that they were referred to by different names for some time before the proper designation was agreed upon. It seems to me that a somewhat analogous condition exists at present in connection with the so-called panel heating systems, which are also called radiant heating, panel warming, etc.

I feel quite sure that a large number of your readers who are interested in this type of heating will be very glad to have a proper designation agreed upon.—D. L. Mills, research dept., Revere Copper and Brass, Inc.

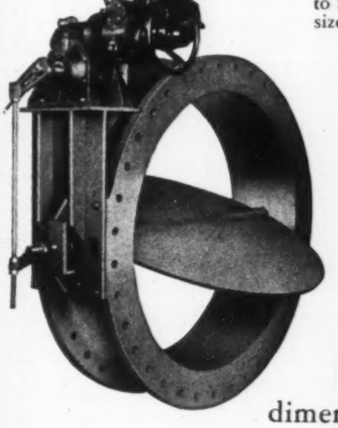
What do you think the term should be? Send us your suggestions for publication.—Editor.

Easy to Operate...

Streamlined for Self-Cleaning



16-inch cast iron chain wheel operated valve for pressures up to 15 pounds. Complete range of sizes from 2-inches to 84-inches.



Automatic electric-motor operated American Standard Valve with hand wheel for manual operation in case of current failure. Available in 125 lb iron, 150 to 900 lb steel.

THE ACTION of an R-S Butterfly Valve is rapid and smooth. Four to six revolutions of the hand wheel or chain wheel fully open or close the valve vane. The compact, inherently narrow face-to-face dimensions, and the fact that there is no long stem or gate well, reduce clearance requirements to the minimum.

There is free passage for direct flow with no restrictions other than the streamlined vane. Sediment cannot collect since there are no right angle bends or reverse turns. Hence, the R-S Valve is ideal for the control and shut-off of dirty gas, dirty water, pulverized fuel or similar flowing solids.

The beveled vane wedges tight against the valve body for shut-off duty.

Write for catalog and detailed information about the use of R-S metals for resistance against heat, abrasion and corrosion.

R-S QUALITY PRODUCTS SINCE 1902

15 to 900 psi

VALVE DIVISION
R-S PRODUCTS CORPORATION
132 Berkley Street, Philadelphia, Penna.

R-S Streamlined BUTTERFLY VALVES

THE ENGINEERING STAFF
THAT DEVELOPED

PETRO
REG. U. S. PAT. OFF.

OIL BURNING SYSTEMS
FOR PEACE

has developed, on confidential assignment, a new Petro unit for war purposes. It may be important in *your* business after Victory.

An entirely different apparatus has been Petro designed at the request of another arm of the service and it, too, may mean something to your "regular business", post-war.

Meanwhile regular, standard Petro Systems are standing up to 24-hour, overload jobs in a large number of America's well-known machine tool factories, in "Government plants", and in conventional applications at fighting bases, on ships, etc.

—and the precision-production skills of our factory are being whetted to a keener edge by the volume production of fighting tools such as firing bolts, shell dies, signal apparatus, and so on.

These things will help to give you better Petro Oil Burning Systems when normal construction is resumed.

Oil Is Ammunition
Use It Wisely

PETROLEUM HEAT AND POWER
COMPANY

Makers of Good Oil Burning Equipment
Since 1903

STAMFORD CONNECTICUT

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 137. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Air Conditioning and Refrigeration

No. 4475—12 p. booklet distributed to employees of the manufacturer's air conditioning and commercial refrigeration department listing war products of this department and typical applications of the equipment and its importance in the war effort.—General Electric Co., 5 Lawrence St., Bloomfield, N. J.

Air Exhausters

No. 4476—4 p. bulletin describing features of "Air-X-Hausters", which are said to provide positive ventilation regardless of wind direction or velocity, with no back drafts. Principle of operation is described and illustrated. Also, 8 p. bulletin on the marine type "Air-X-Hauster", through which no light can escape, including table of dimensions, sketches, and capacity and performance tables for above deck and porthole types.—G. C. Brejdert Co., 3328 S. Central Ave., Los Angeles, Calif.

Asbestos-Cement Pressure Pipe

No. 4477—4 p. bulletin (D) describing "Eternit" asbestos-cement pressure pipe for industrial use.—Ruberoid Co., 500 Fifth Ave., New York, N. Y.

Bending Machines

No. 4478—12 p. bulletin on compression process bending machines discussing the art of bending, machine selection, machine operation, and with tables on the properties of pipe, strength of materials, section moduli of pipe, and list of available dies. According to the manufacturer, it is possible to make elbows on pipe at a cost of three cents each.—Pedrick Tool & Machine Co., Inc., 3640 N. Lawrence St., Philadelphia, Pa.

Boiler and Tank Coating

No. 4479—4 p. bulletin on "Serviron" interior boiler and tank coating which is a permanently plastic material applied like paint to protect against corrosion and fungus growth. According to the manufacturer it will not melt, freeze, crack, or peel at temperatures from below freezing to 500-550 F.—Saverite Engineering Co., 1031 Clinton St., Hoboken, N. J.

Butterfly Valves

No. 4480—4 p. bulletin (16-B) on butterfly valves for regulation and shutoff duty on air, gas, steam, liquid, and semi-liquid pipe lines under both manual and automatic control. Specifications for pressures from 15 to 125 psi are given and there are complete dimension tables.—R-S Products Corp., Germantown Ave. at Wayne Junction, Philadelphia, Pa.

Flexible Metal Hose

No. 4481—36 p. catalog (113) dealing with general industrial applications of flexible metallic tubing with complete data on available fittings, both industrial and SAE. Pressure charts, charts showing radius of bend, and other essential data are incorporated and many types of applications are pictured and described. Instructions for installation are given.—Titeflex Metal Hose Co., 500 Frelinghuysen Ave., Newark, N. J.

Gas Burners

No. 4482—16 p. bulletin on "Infra-Red Principle" gas burners used in heating work, industrial high pressure steam boilers, soft metal melting, varnish cooking, paint drying, annealing, food processing and baking, and other similar applications. Features include, according to the manufacturer, no heat loss from burner to product, greater speed of heat transmission, reduced fuel consumption, and uniformity and improved quality of product. The principle is explained, typical applications are diagrammed and described, and capacities are given.—Burdett Mfg. Co., 19 Loomis St., Chicago, Ill.

Hot Process Softener

No. 4483—4 p. reprint (25) entitled, Operation of Hot Process Softener at 50 Lb Gage Improves Performance and Saves Chemicals, by C. E. Joos and Frank Kemmer. The installation discussed, with a capacity of 28,000 gph, is believed to be the first and only hot process softener in service operating under the 50 lb pressure and 298 F temperature conditions. Saving in both lime and soda ash is secured.—Cochrane Corp., 3131 N. 17th St., Philadelphia, Pa.

Motors

No. 4484—16 p. bulletin (form 344A) on squirrel cage induction polyphase motors, 1/6 to 600 hp, giving the steps required to select the motor best suited for the application. Much information on construction is included.—Century Electric Co., 1806 Pine St., St. Louis, Mo.

Photocopies

No. 4485—Leaflet illustrating and describing the "Apeco" machine for making photo copies.—American Photocopy Equipment Co., 2849 N. Clark St., Chicago, Ill.

Pipe Templates

No. 4486—12 p. bulletin giving pipe templates for welding fittings, telling how to fabricate the fittings by means of flame cutting and welding. The procedures described are intended primarily for use where special fittings are required or where stock fittings may not be available when needed.—Air Reduction, 60 E. 42nd St., New York, N. Y.

Protective Coatings

No. 4487—12 p. data bulletin summarizing the properties of "Ucilon", a surface coating material that stands up under many corrosive service conditions. Applications are listed and the materials which the coating resists are shown. Instructions for application are given.—United Chromium, Inc., 51 E. 42nd St., New York, N. Y.

Sheet Metal Structure

No. 4488—8 p. booklet on "Lindsay" structure, a method of using "pre-tensed" sheet metal in light structures of high strength and rigidity. Applications include housings for equipment of all kinds. Complete details in both words and pictures are presented.—Lindsay and Lindsay, 4825 S. Rockwell St., Chicago, Ill.

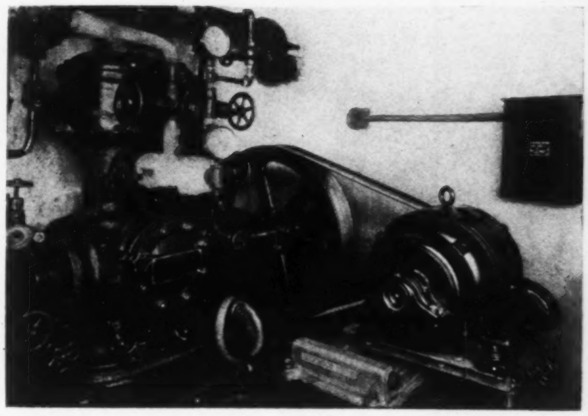
Storage Tank Oil Heater

No. 4489—12 p. bulletin (1641) on "G-Fin" storage tank oil heater explaining the unique construction of the fin elements, showing the advantages, of the heater design, and explaining the different arrangements in which the heater is furnished. Complete tables of dimensions and ratings are given.—Griscom-Russell Co., 285 Madison Ave., New York, N. Y.

Storage Water Heaters

No. 4490—6 p. bulletin (35-75C) illustrating and describing storage water heaters of the horizontal and vertical types with U-tube elements, including details of construction, standard sizes, capacities and dimensions, etc.—American District Steam Co., 25 Bryant St., North Tonawanda, N. Y.

for a DEPENDABLE
Air Conditioning Drive



Use the Tannate-Rockwood Drive . . .

It is a consistent performer that keeps power flowing steadily whatever the fluctuation in load.

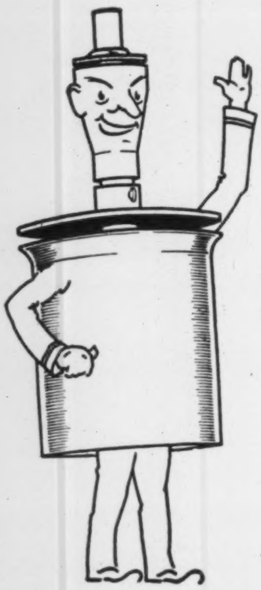
When the load varies, the weight of the motor on the pivoted Rockwood base automatically adjusts the belt tension . . . so that at no time is the high transmission efficiency of the Tannate belt impaired. The belt grips tightly, runs smoothly, pulls steadily with all the efficiency characteristic of Tannate.

Remember the combination: Tannate flat leather belting used with the Rockwood pivoted motor base for air conditioning drives!

RHOADS
Tannate-Rockwood
PRODUCTION DRIVE

—Established 1702—

J. E. RHOADS & SONS
35 North 6th Street Philadelphia, 6, Penna.
NEW YORK • CHICAGO • ATLANTA • CLEVELAND



"In ADDITION to John Zink BURNERS we can Now Make

Grey Iron Castings"

We now operate a complete pattern shop and a foundry specializing in Light Weight Complicated Castings.

John Zink manufactures more than FIFTY TYPES of gas burners, oil burners and combination burners for domestic boilers, heating boilers, industrial boilers and power boilers. The designs are protected by TWENTY United States Letters of Patent.

—SPECIAL BURNERS DESIGNED AND MADE TO ORDER—

John Zink Co.

TULSA, OKLAHOMA

New York • Los Angeles • Detroit • San Francisco

Tubular Rivets

No. 4491—12 p. bulletin on "Rivnuts", which are internally threaded and counterbored tubular rivets which can be headed blind and have a great many applications both on airplanes and in other industrial fields.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Ventilation

No. 4492—32 p. booklet entitled The Case of the Careless Kitchen and other Crimes, describing in interesting manner a number of ventilation problems and how they were solved. —Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.

Welding Positioners

No. 4493—2 p. bulletin (196) describing hand operated welding positioner with a capacity of 2500 lb with center of gravity of load 6 in. away from table top. Also, 2 p. bulletin (188) describing turning rolls for facilitating welding of large cylindrical tanks and drums.—Ransome Machinery Co., Dunellen, N. J.

Zinc Plated Steel

No. 4494—Leaflet describing zinc plated steel sheets, offered as a practical alternate for more critical materials, summarizing sizes, gages, finishes, and properties.—American Nickeloid Co., 113 Second St., Peru, Ill.

"OPEN FOR DISCUSSION"

Preparing Specifications

Here are my comments on that fine article by John J. Woolfenden on Preparing the Specifications for Small Arms Munitions Plants, which was published in the June HPAC:

1) I read the article with great interest, impressed with Mr. Woolfenden's thorough knowledge of his subject.

2) I like the idea of basic and supplementary specifications, the one with information of a general character common to many items, and the other with information on specific sizes, types, and additional details.

3) I like the cooperation of design and specification departments, with their analysis of the job, picking out critical long term delivery items for earliest attention, scheduling, etc.

4) I like the thorough system of specification manuscript, transcribing, and final checkups. This should eliminate so many of the errors that one sees in the final printed specifications on large projects.

5) I like the mention of specific makes of acceptable materials, with the notation in a conspicuous spot that such mention is not to be considered prejudicial to equivalent competitive materials which may be submitted for approval before purchase.

How would the author like to give us a sample specification of a specific job? I would like to read the actual words of one of Mr. Woolfenden's specs. I would like to see an outline of the basic and supplemental specs with the headings of each topic, and with the special features given in full.—ROBERT E. HATTIS, consulting engineer.

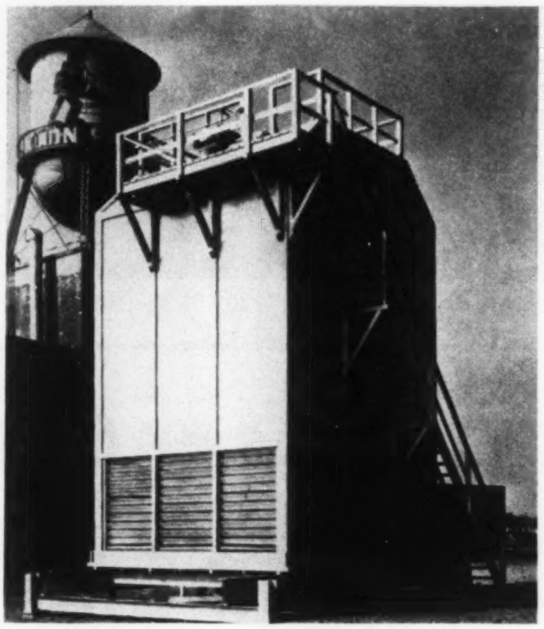
Lilie-Hoffmann

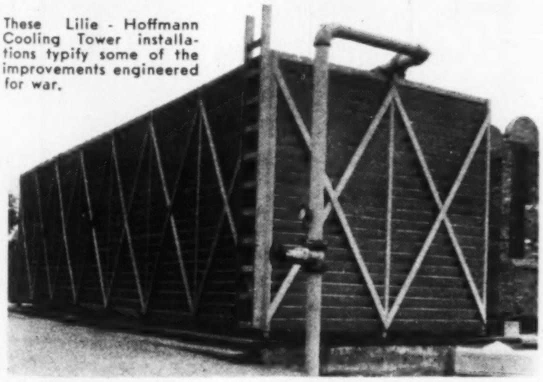
Will Be READY!

After the war is won and peace-time manufacture again gets under way, there will be many advancements in the air-conditioning field.

Foremost among them will be new designs, new engineering features and new construction perfection in Lilie Hoffmann Cooling Towers.

Lilie Hoffmann engineers will be ready to meet your demands for better equipment and lower operating costs with individually-designed installations.





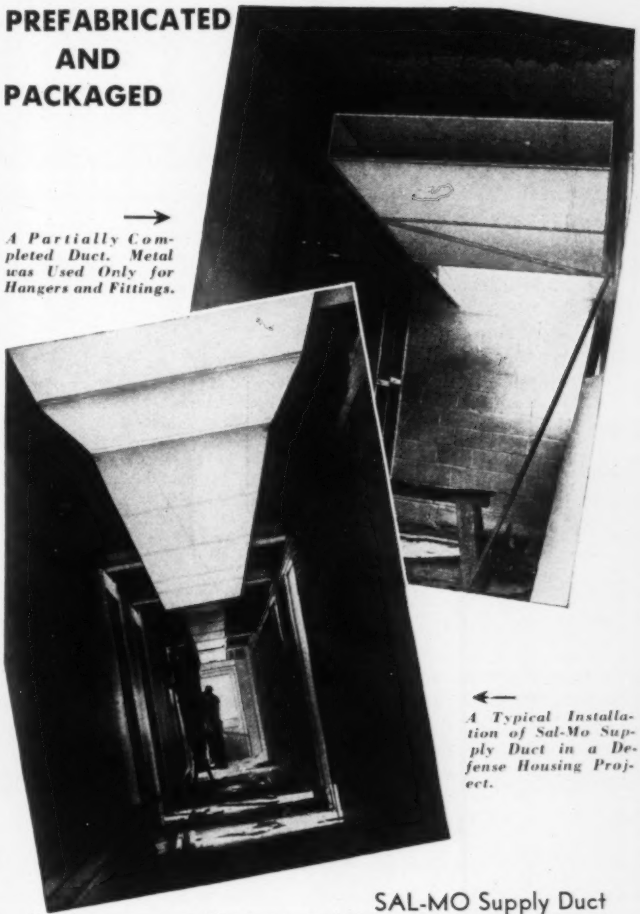
These Lilie - Hoffmann Cooling Tower installations typify some of the improvements engineered for war.

LILIE-HOFFMANN COOLING TOWERS, Inc.
4239 Duncan Ave., St. Louis, Mo.

OLDEST IN EXPERIENCE

SAL-MO SUPPLY DUCT

PREFABRICATED AND PACKAGED



→ *A Partially Completed Duct. Metal was Used Only for Hangers and Fittings.*

← *A Typical Installation of Sal-Mo Supply Duct in a Defense Housing Project.*

SAL-MO Supply Duct is the non-metallic material for constructing supply and return ducts for Warm Air Heating, Ventilating and Air Conditioning Systems. Its use permits many installations that would otherwise be impossible because of the Government rulings restricting the use of metals.

Sal-Mo Supply Duct is prefabricated and packaged in cartons at the factory. It is quickly installed saving many hours in erecting time. It also reduces shipping, trucking and storing costs to a minimum.

Ducts constructed of Sal-Mo Supply Duct are tight, quiet and insulated. Low conductivity rate assures efficient operation in both heating and cooling systems. Smooth interior surfaces give low friction loss. Air tight construction prevents heat loss.

APPROVED AND LISTED by Underwriters Laboratories, Inc.

Sal-Mo Supply Duct is tested for Fire Hazard Classification; inflammability; Fire Retardant Classification; Fire Spread; Moisture Absorption. It has a "K" Factor of 0.294 B. T. U. Available in 26 sizes for domestic and industrial installation, and in flat sheets.

Sall Mountain Company also manufactures Asbestos Paper, Millboard, Pipe Joint Tape, Pipe Coverings, Cements and many other Insulation Materials.

Phone Andover 2414

SALL MOUNTAIN COMPANY

176 W. Adams Street Dept.-F, Chicago

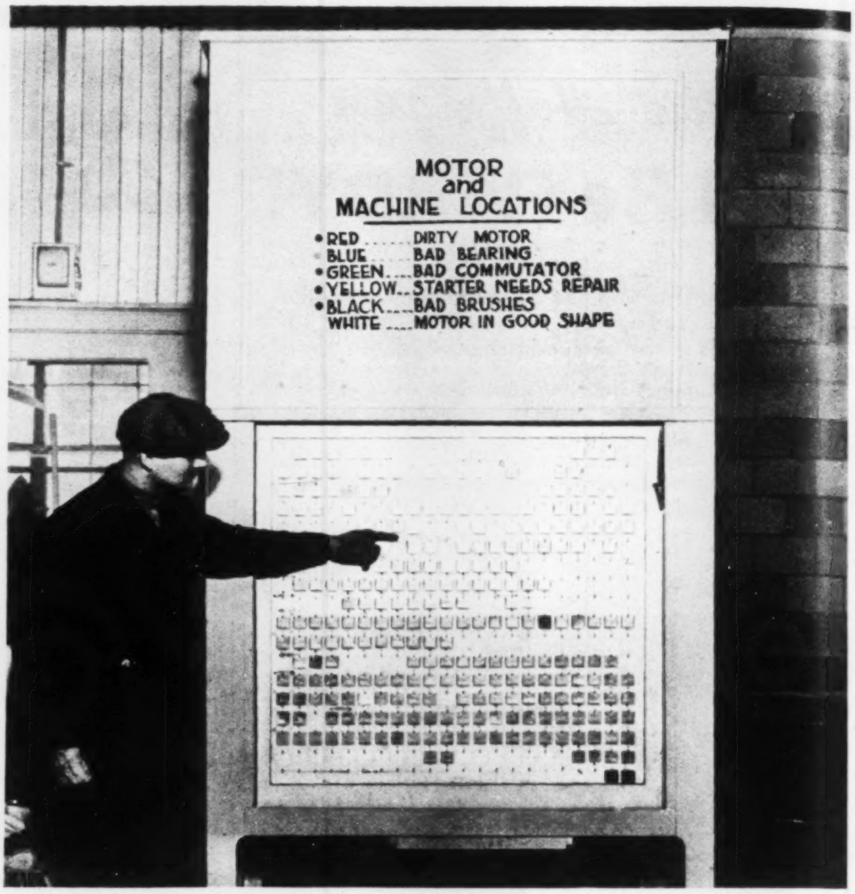
How Industrial Plant Speeds Maintenance

A simple, practical "motor board" for checking the condition of every electric motor in an entire plant in a few minutes has been designed and is being used by the LaPorte, Ind., works of Allis-Chalmers Mfg. Co.

In the process of stepping up routine maintenance to a wartime tempo, a need was found for centrally recording the results of periodic motor checkups. A cabinet was designed to hold a number of boards approximately 4 ft square. Divided into an upper and a lower half, the cabinet recesses the boards in the upper half while those below are observed, since they are arranged one in front of the other. Boards can be raised from the bottom half and locked in place in this upper "hood."

Key to the system of maintaining a constant check on the plant's motors are small metal tags, each of which is stamped with the number of a motor in the shop. Each board represents a shop, and the position of the hook on which each tag hangs represents the position of that motor in the shop. If the motor should be moved to another location, its tag is simply transferred.

As motors are inspected, or reports on their conditions are received from the shops, these specific conditions are indicated on the board with colored pins placed under the tags.

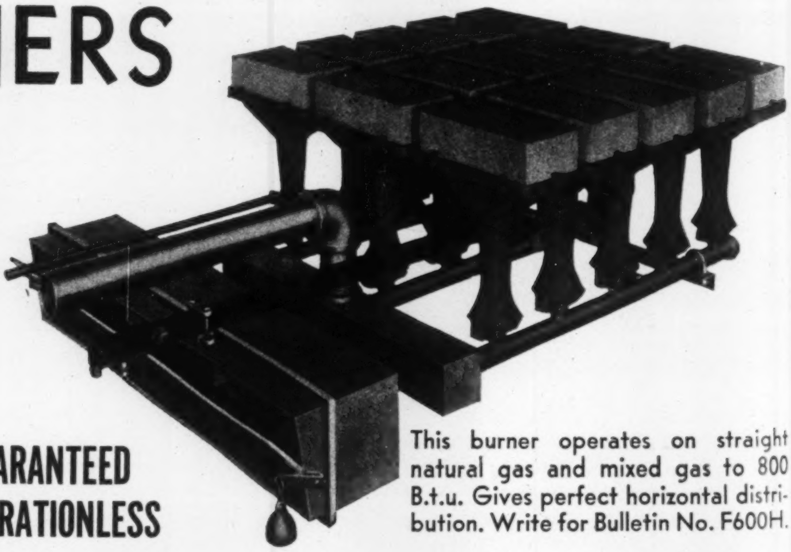

MOTOR and MACHINE LOCATIONS
• RED ...... DIRTY MOTOR
• BLUE ...... BAD BEARING
• GREEN .... BAD COMMUTATOR
• YELLOW .. STARTER NEEDS REPAIR
• BLACK .... BAD BRUSHES
WHITE .... MOTOR IN GOOD SHAPE

This motor board shows the condition of every motor in the entire plant.

WECO-N. G. E. Series F600
GAS BURNERS

These burners are available for ratings from 50,000 to 10,000,000 B.t.u. output, for use in heating boilers, power boilers—in any metal firebox or sectional boiler.

Featuring flexibility to meet various firebox shapes and sizes at various gas pressures, and low draft loss. Full automatic controls that operate properly can be easily applied.



GUARANTEED VIBRATIONLESS

This burner operates on straight natural gas and mixed gas to 800 B.t.u. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

THE WEBSTER ENGINEERING CO.
TULSA —DIVISION OF— **OKLAHOMA**
Surface Combustion . . . . Toledo, Ohio

Useful Information

Order M-28 on Refrigerants Amended

Following is amendment No. 2 to the War Production Board's general preference order No. M-28, to conserve and direct the distribution of chlorinated hydrocarbon refrigerants:

Section 970.1—General Preference Order No. M-28, as amended, is hereby amended as follows:

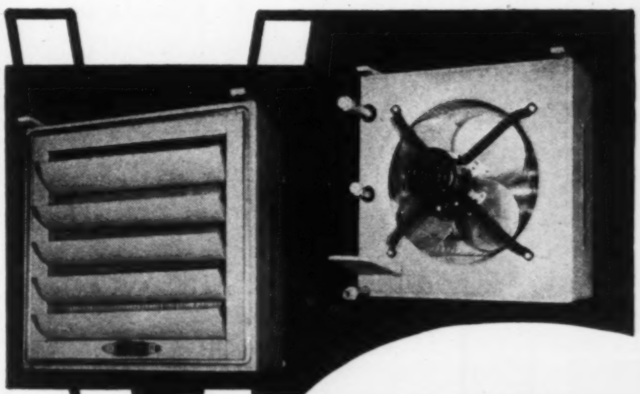
1. Paragraph (d) is hereby amended to read as follows:

(d) **Restriction on deliveries,** notwithstanding the provisions of paragraph (b) and (c) above, and notwithstanding the provisions of any other orders, rule or regulation of the War Production Board, no person shall sell or otherwise transfer or deliver any chlorinated hydrocarbon refrigerants except in accordance with the following directions:

(1) (i) On and after June 5, 1943, no producer, dealer or any other person shall sell or otherwise transfer or deliver any chlorinated hydrocarbon refrigerants to any other person for installation or use in any air conditioning system which is a "comfort cooling system", as defined under paragraph (d) (1) (ii) of this order; and no person shall purchase or receive delivery or transfer of any chlorinated hydrocarbon refrigerants for installation or use in any "comfort cooling system".

(ii) For the purposes of this paragraph (d) "comfort cooling system" means any system of any size, operated or installed for the purpose of lowering the temperature and/or humidity of air in any building, room or other enclosure used as, or located in any of the following:

Amusement parks.
Animal hospitals.
Auditoriums.
Ballrooms, dancing studios, and dance halls.
Bank and loan associations.
Bars, cocktail lounges, and beer parlors.
Bowling alleys.
Concert halls.
Funeral parlors.
Golf clubs, country clubs, and athletic clubs.
Hotels and apartment houses.
Moving picture houses.
Night clubs.
Office buildings and offices, public or private.
Railway, streetcar and bus stations and terminals.
Residential buildings and dwellings of all kinds.
Restaurants, cafeterias, and other places selling meats, food or beverages.
Schools.
Service establishments, such as laundries, cleaners and dyers, tailor shops, barber shops, "beauty" parlors, automobile sales and service shops, and repair shops of all kinds.
Skating rinks.
Stores, selling any kind of products, material, or merchandise, at retail or wholesale (excluding manufacturing establishments).



KRAMER Victory COOLMASTER

NEW DESIGN FOR QUICK DELIVERY

An all steel hot galvanized coil is used in the Victory Model Coolmaster. This line of units is designed to comply with the latest government limitations on crtiical materials. The number of models has been reduced to facilitate quick delivery.

OUTSTANDING FEATURES

Accurately rated. All ratings based on tests made in accordance with accepted standards and are guaranteed.

All steel spiral fin coil, hot galvanized after fabrication.

No welded or soldered return bends.

Can be used with Freon, Methyl, Sulphur, Ammonia, or Brine. Please specify if ammonia or brine will be used.

Heat interchanger is furnished.

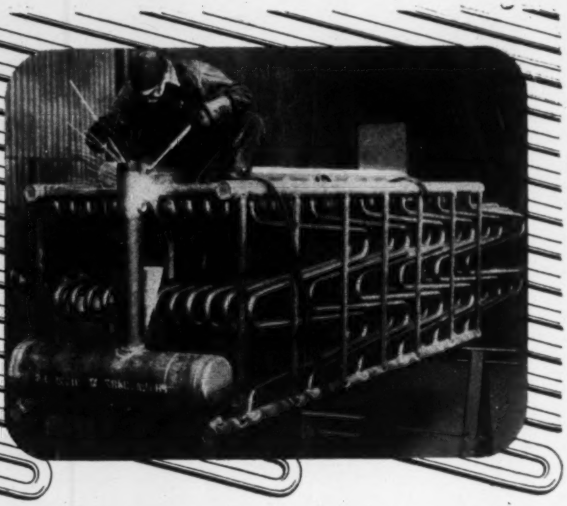
One man suspension brackets for easier mounting.

Unusually pleasing in appearance. Finished in chrome gray shade of crackle; baked on a bonderized (rustproofed) base.

Silent, carefully balanced fans, direct connected to totally enclosed motors specially built for fan duty and long life.

Send for Bulletin R-143

KRAMER TRENTON CO.
Trenton, N.J.

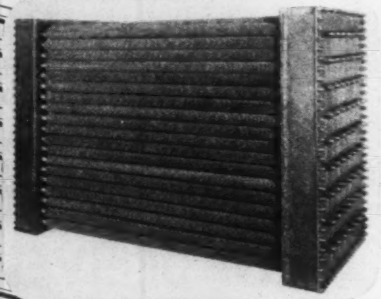


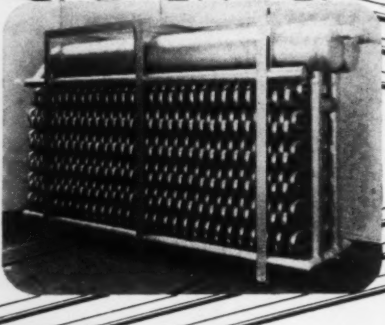
They're engineered to your needs: specify FRICK cooling coils—

Consider the examples illustrated. Note the large headers, the liquid surge drum, and the short gas travel in the ice tank coil above, known as a Vertiflow unit.

Maintains high suction pressure, saves both power and space.

At left is a big finned coil, 6½ ft. long, with box type headers; one of a group which cools air to 67 deg. below zero Fahrenheit.





Right: Special VW nested coil with double accumulators, used in a Blizzard quick-freezer.

Left: Large "book" type finned coils of welded construction, the latest development, ready for shipment.

We make finned as well as bare pipe coils, to suit your exact needs, and offer the benefit of our 90 years' engineering experience in solving your problems. Write for Bulletin 156 on Frick Coils.

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

The term "comfort cooling system" shall n include (a) any such system used to air cond tion a building, room, or other enclosure use chiefly for purposes not listed above, or (b any system designed, necessary and used, substantial part for the refrigeration and stor age or processing of food, ice, or other mat rials or products requiring refrigeratio temperature control, or freedom from dust other impurities, or (c) such part of a syste as may be necessary and used for the circul tion of air, or necessary and used for raisi the temperature of air during cold weather a degree which is comfortable or tolera for persons (comfort heating).

(2) No distributor of such refrigerants, and dealer or other person who furnishes such frigerants to any person acquiring the sa for use as refrigerants, shall sell or otherw transfer or deliver any such refrigerants oth wise than in accordance with the following rections: Orders for such refrigerants sh be divided, commencing June 5, 1943, into following three classifications:
   (i) Classification I—Maintenance of refri eration equipment already installe Maintenance of air conditioning equ ment already installed in hospita clinics, and sanitoria.
   (ii) Classification II—Maintenance of indu trial air conditioning already installed
   (iii) Classification III—Manufacture of ne refrigeration equipment. Manufactu of new air conditioning equipment for dustrial air conditioning.

Supplies of such refrigerants for uses enu erated in Classification I shall be given pr mary preference. If it appears, in any mont that the available supply for that month w exceed the amount estimated to be requir for the uses enumerated under Classification supplies for uses enumerated under Classific tion II shall be given secondary preferen If it appears, in any month, that the availa supply for that month will exceed the amou estimated to be required for the uses enume ated under Classifications I and II, the re dual supply shall be divided among us enumerated under Classification III. If it a pears, in any month, that the available sup for any classification is less than the existi demand in that classification, the distribu or dealer shall allocate the available sup ratably among the users in accordance with average monthly consumption by such use during the period from July 1, 1940, to J 30, 1941.

(3) Producers of such refrigerants shall ma deliveries thereof for use in refrigeration or conditioning equipment in accordance with foregoing directions, as set forth in (d) above for distributors, dealers, and other p sons delivering such refrigerants to perso acquiring the same for use, unless and un otherwise authorized or directed by the W Production Board.

Issued this fifth day of June, 1943.

Lacquer "Footprints" Locate Strains

The lacquer-held "footprints" of a bullet crashing in steel plate are giving scientists new information which ma aid in the development of tougher armor and better arm piercing shells. The "footprints" are thin, closely spac cracks which appear on a lacquer-coated steel target und the impact of a speeding bullet. Dr. Miklos Hetenyi is co ducting the experiments in the Westinghouse resear laboratories.

HOW FUEL OIL USERS CAN

Convert to Coal AND Save Money

with FREEMAN

COMMERCIAL
AND
INDUSTRIAL **STOKERS**

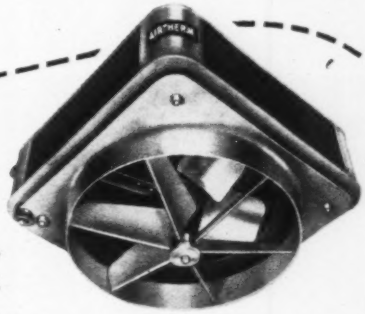
(COMPLETE RANGE OF SIZES: 75 TO 1200 POUNDS PER HOUR)

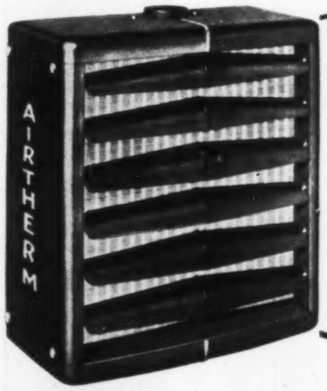
- **Most commercial and industrial oil burners must now be converted to coal!** You can make big money . . . and render vitally important service . . . by speeding this change-over with Freeman Stokers. Freeman is first choice of America's foremost heating engineers . . . has a time-proved record of dependability and long life . . . is manufactured by a pioneer leader in the stoker industry, rated AAA1, established 1864. Write immediately for details on your territory!

FREEMAN STOKER DIVISION, ILLINOIS IRON & BOLT CO.
GENERAL SALES OFFICES: 918 SOUTH MICHIGAN AVE., CHICAGO, ILL.

AIRTHERM
UNIT HEATERS

FOR VERTICAL DELIVERY





FOR HORIZONTAL DELIVERY

Extra-heavy tube-wall thickness of .065" for greater resistance to internal corrosion * Ingot iron tubes * Tubes and headers are welded and brazed into an integral unit guaranteed to withstand steam pressure up to 150 lbs. per sq. in. * Coils with lead alloy coating * Fins and tubes sealed by press-fit bond so that rust will not reduce the heat transfer.

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. · ST. LOUIS, MO.

Some shots fired in the laboratory create a heart-shaped pattern extending 6 or 8 in. from the spot where the bullet hit or penetrated. In other tests the cracks form a series of circles around the bullet hole. Each tiny crack denotes stretching of the metal underneath the lacquer and gives a permanent picture of the strains that occurred at the instant of impact.

By spraying this smooth lacquer coating, known as "Stresscoat," on metal parts and then contorting them until the brittle skin cracks, Dr. Hetenyi and other research engineers can also detect vulnerable spots in gears, shafts, valves, and other equipment.

This lacquer coating test, Dr. Hetenyi said, is accelerating improvements in motors, gears, and various types of electrical machines because it enables research engineers to locate strains quickly. Life tests are still necessary but the cracked coating process tells when engineers are on the right track in designing new parts.

Just as yawning crevices opened by an earthquake reveal faults deep underground, tiny fissures in the lacquer tell a story of the strains that machine parts experience. Cracks in the glossy finish pick out the "Achilles heel" of an 8 ft high, 2 ton gear wheel or bare the weak points of a flapper valve, a 1/10 oz slice of steel that vibrates back and forth in air cooling machinery.

In one test, the lacquer coating was put on a 1600 lb "model" of a gear tooth and the tooth was squeezed in a large hydraulic press to locate accurately the stresses.

Lacquer sprayed on the gear tooth dries in 15 hr to form a tightly clinging skin about as thick as the diameter of a human hair. To determine the slightest strain that will crack this coating, a 1 ft steel bar is sprayed at the same time as the gear tooth and under the same atmospheric conditions.

The steel bar is bent in a machine that holds it rigid at one end and depresses it at the other. Most of the cracks in the coating appear at the rigidly held end and become less frequent until there are none at the end which was pushed down. Then the bar is placed beside a strain scale which is read opposite the point where the last crack occurred. This reading tells the minimum strain—that is, the least amount the metal must "stretch" to split the lacquer.

The coated gear tooth is then subjected to the same kind of punishment it would get when at work in a machine. It is slowly squeezed in a press capable of exerting a force of 400,000 lb while the laboratory workers scan the coating for the first appearance of a crack. With more pressure the "skin" splits in other places and finally the research men have a progressive list of the tooth's weak points.

A similar test was devised for flapper valves, the slivers of tough steel that quiver millions of times a week to regulate the flow of liquids and gases in refrigerators and air conditioning machinery.

Parachute Drying a Vital War Role of Air Conditioning

One of the many vital war roles being performed by modern air conditioning is in the drying and storage of parachutes, officials of Carrier Corp. pointed out recently.

As a case in point, air conditioning equipment has been installed recently in a parachute drying tower in a tropical zone. Because parachutists frequently land in marshy or swampy terrain or even in the sea, it is imperative that their parachutes be immediately washed and dried to prevent deterioration.

The drying tower consists of two sections. In one, 30,000 cfm of heated air and 100,000 cfm of outside air enter through nozzles on the ceiling and blow vertically downward over the 'chutes, which are suspended from the ceiling. The air is exhausted at floor level. After most of the free moisture (up to 25 per cent by weight) is removed, the 'chutes are taken down and hung in the much larger section where the moisture content of the 'chutes is brought to the correct value. They are then removed to large air conditioned rooms for folding, packing, and storage.

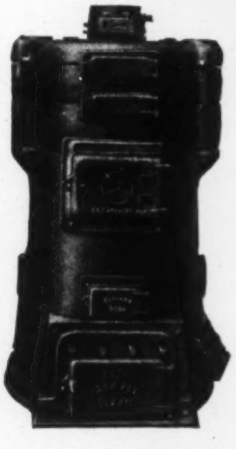
Ask Dad—
He Knows

If ever this old adage fitted anything, it's the Burnham Round Boiler.

For years it has been the "*Standard for Comparison*" in service, economy and ease of handling.

For Heating—there are twelve sizes.

For Hot Water Supply—there are ten sizes ranging in capacity from 160 to 485 G.P.H. 100° rise.



When furnished for Hot Water Supply, boilers are made from special heavy duty patterns.

FOR VICTORY
BUY
UNITED STATES
WAR
BONDS
AND
STAMPS

Burnham Boiler Corporation
IRVINGTON, NEW YORK, *Dept. P*
ZANESVILLE, OHIO, *Dept. P*

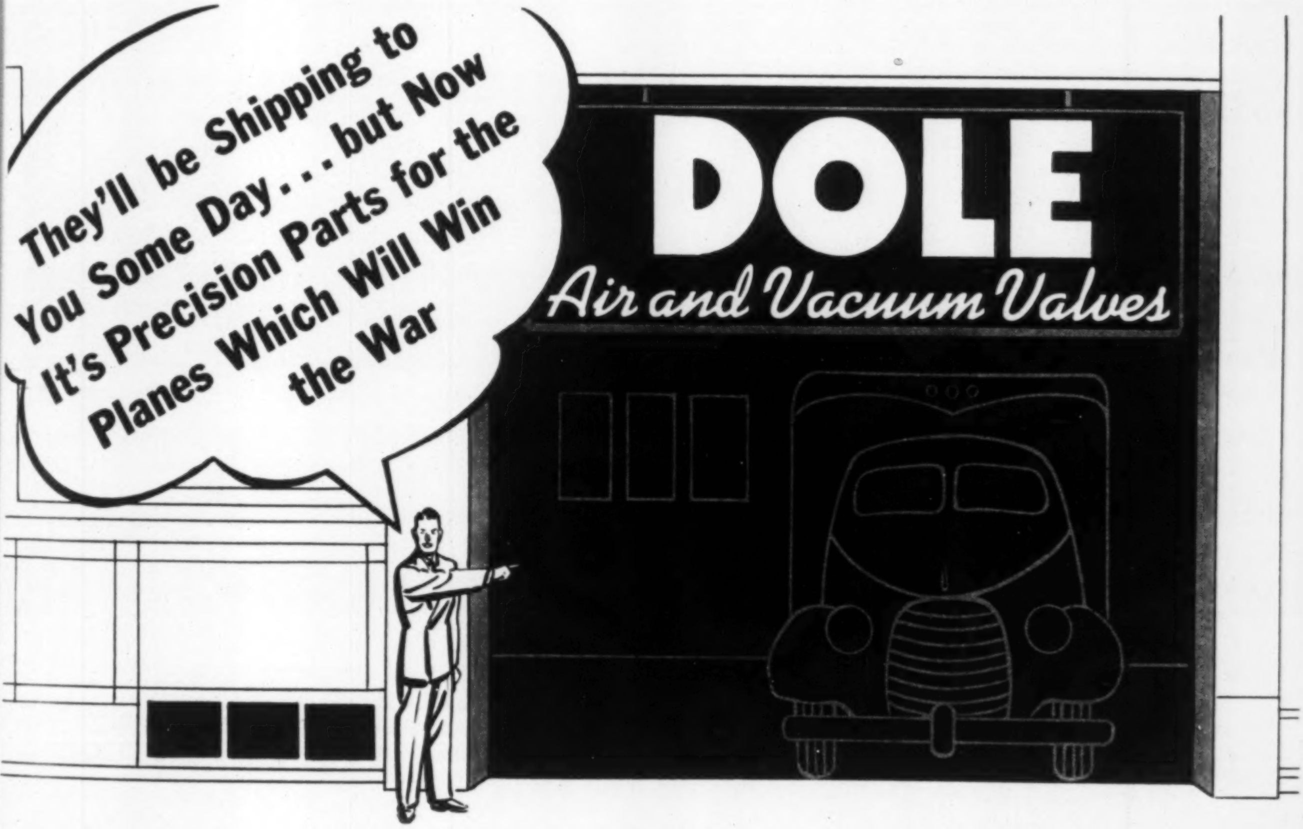
WHEN THE NAVY WANTS "Action"

This O&S Boiler delivers it *Fast!*

Built by O & S engineers for use at Advance Naval Bases — these fully-automatic units generate steam with the speed Navy men demand. The new boilers develop 100 lbs. pressure from 60° water in 18 minutes — or less!

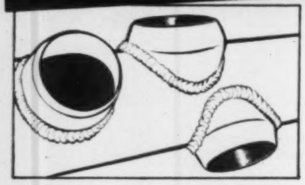
Right now, these compact, efficient units are tagged "For Uncle Sam" . . . and some for plants with an AA-2 priority or better. But others will want to investigate now, for the day when Victory makes O & S Boilers again available for all purposes.

ORR & SEMBOWER INC.
READING • PENNSYLVANIA
O&S
Builders of Better Boilers
Since 1885

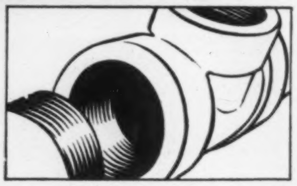

They'll be Shipping to You Some Day . . . but Now It's Precision Parts for the Planes Which Will Win the War
DOLE
Air and Vacuum Valves

THE DOLE VALVE COMPANY
1901-41 Carroll Avenue, Chicago, Illinois • ***Representatives in Principal Cities***

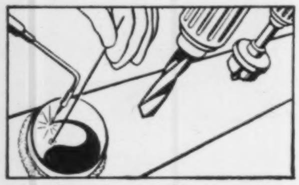
HOW W-T'S* SPEED UP PIPING INSTALLATIONS



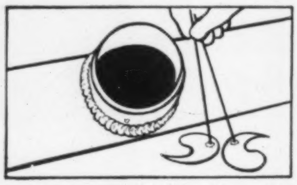
1. Branch pipe outlets can be made with W-T's* anywhere on the main pipe without the use of templets.



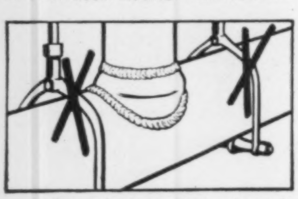
2. W-T's* eliminate all threading and fitting of main pipe in making branch pipe outlets.



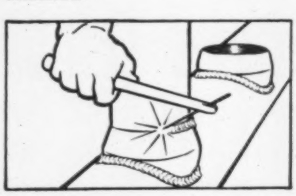
3. If outlet is 2" or smaller, hole is cut in the main pipe with drill or hole-saw before W-T's* are installed—on larger sizes with torch after installation.



4. The use of W-T's* permits inspection of inside of joint, removal of scale and excess weld metal before branch is attached.



5. Funnel-shaped intake of W-T's* reduces vibrational stress at junction—eliminates need of extra braces and hangers.

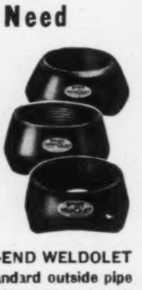


6. Branch pipe is attached to outlet of fitting by welding—or, if outlet is threaded by screwing into outlet of fitting. W-T's* provide leakproof junction of full pipe strength

W-T's* are suitable for all commonly used pressures and temperatures in every type of piping system. They can be installed before or after erection of the main line with ease and economy. Equally well adapted to pre-fabricated or "on-the-job" assemblies. Cost no more—in many cases less than ordinary fittings without their advantages. Stock fittings of drop forged steel, but to meet special conditions can be supplied in Monel, Everdur, Toncan Iron, wrought iron, etc.

Write for Bulletin WT-31 giving complete description of all advantages.

3 Types Meet Every Need



Beveled outlet of WELDOLETS permits branch pipe to be attached with plain butt weld.

Threaded outlet of THREDOLETS permits branch pipe to be screwed into outlet of fitting.

Outlet of SOCKET-END WELDOLET is bored to accept standard outside pipe diameters. Junction is completed with weld around top of fitting.

All 3 types available for all standard pipe sizes up to 24".

*WeldOlets-ThredOlets

Forged Fittings Division

Bonney Forge & Tool Works, Allentown, Pa.

ARMY E NAVY

WELDOLETS·
TRADE MARKS · REG U S PAT OFF
THREDOLETS
Welded Outlets for Every Piping System

At the base, three heat diffusers supply heated air to the two sections of the drying tower, while self-contained air conditioning units supply 50 tons of cooling affect for air conditioning for the folding, packing, and storage rooms and for offices.

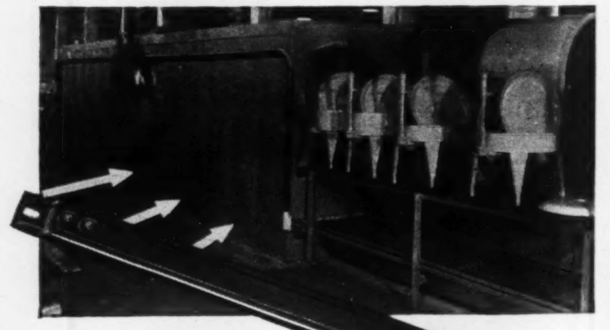
Most parachute maintenance buildings will have a tower approximately 40 ft high where the parachutes are hung and fluffed out following the routine of 30 or 60 day inspection before repacking. It is important that the relative humidity within a drying tower be kept below 50 per cent and that outside air be circulated through the tower to prevent mildew, which damages silk fabric. This may be accomplished either by using a dehumidifying unit comprising a compressor, evaporator, and hot gas reheat coil with fans for air circulation, or by using a heat diffusing unit.

In some parachute maintenance buildings bins are provided for storing packed parachutes. This section is partitioned off from the rest of the shop and equipment is provided to keep the space ventilated and the humidity below 50 per cent. In some cases it has been possible to install bins in a section of the drying tower and to combine the two functions in one piece of apparatus.

GIVE
RED CROSS
WAR FUND

In the tropics and at some advanced bases where heating units are impractical from the fuel standpoint, a dehumidifying unit is an economical and practical choice for maintaining proper conditions in drying towers. In some tropical work rooms, complete air conditioning has been installed to prevent dust and excessive sweating of parachute riggers, thus preventing perspiration from dripping on the 'chutes while they are being folded. In such cases, 80 F dry bulb and 50 per cent relative humidity are provided.

ELECTRIC HEAT for oven eliminates summer boiler use



When this paint drying oven was converted to electric heat, important savings immediately became apparent.

CHROMALOX
ELECTRIC STRIP HEATERS

were installed, with automatic temperature control. Results:

- Shutdown of expensive steam boiler operation—
- Quick heating of oven at start of day—
- Greater comfort for operators because of localized heat—
- Elimination of humidity—
- Complete uniformity of dried finish, due to unvarying temperature—
- Increased production—more rapid drying.

The Wiegand consulting staff will be glad to give estimated costs and application data for electric heat on any industrial process job you may have. Write us the conditions and include a rough pencil sketch.

For valuable electric heating data, write for the Chromalox 64-page catalog.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

Markets After the War

Markets After the War, a volume recently released by the Department of Commerce, is described as an overall economic roadmap pointing toward a potential era of unparalleled peacetime prosperity for the United States.

It finds that the major potentials will be present the day victory is won—employment on an unprecedentedly high level, the greatest productive plant of all time, national income at a peak hardly dreamed in prewar years, with a large volume of accumulated savings, and an unmeasured demand for goods denied to the consumer by war's exactions. The big problem is to prepare now to so manage these factors as to translate potentials into realities. This is said to be primarily a job for private enterprise, aided and supported by government.

Prepared by the bureau of foreign and domestic commerce under the direction of S. Morris Livingston, chief of its national economics unit, at the suggestion of the committee for economic development, the publication is designed to assist marketing analysts in setting their sights on a common goal of greater postwar opportunity for American business.

Starting with the now widely accepted proposition that a high level of highly productive employment must be maintained after the war, it seeks to answer three general questions:

1) What would total business volume be if most of the people who will want to work after the war do have productive jobs?

2) How does the war affect the possibility of reaching that goal? What will be the magnitude of the accumulated demand for goods? How big a backlog of purchasing power in the form of extra savings? What obstacles must be overcome?

3) What opportunities would such a national market offer the individual business? How can this market potential be measured?

Airplane Heating Systems Analyzed

Heating airplanes has lagged behind other improvements, Wilbur W. Reaser, engineer in charge of air conditioning, Douglas Aircraft Co., Inc., Santa Monica, Calif., said in an address to the American Society of Mechanical Engineers at its semi-annual meeting last month. But since war has shown that heating systems are essential equipment, he predicted that in the future they will be more efficient, lighter, last longer, and be simpler to operate. They will have to be, he said, because war has proved airship effectiveness depends on proper heating.

"Because the airplane heating system was often not recognized as essential equipment until the war, its development has not kept pace with other functional equipment," said Mr. Reaser. "However, better methods of determining heating requirements and performance are now available. Extensive ground and flight testing will further improve heating systems. They point the way toward heating equipment having a higher heat output and longer life, lighter in weight, simpler to operate, and more reliable.

"Prior to the war, an airplane cabin heating system, although required to conform to certain specifications, was more likely to be relegated to any space remaining after other equipment was designed. Wartime flying in the far north and the troposphere has proved that airplanes are not effective unless they have adequate heating systems."

The speaker listed six properties to be determined before the heating system can be designed. He discussed the advantages gained by supplying the heating distribution system with temperatures as high as possible, and gave computations showing why a ceiling air distribution system is preferable to a floor distribution system. He showed diagrams comparing thermal circuits for the wall of an airplane cabin and for a man's body, and compared advantages and disadvantages of three heating systems used by Douglas—steam, exhaust hot air, and internal combustion.

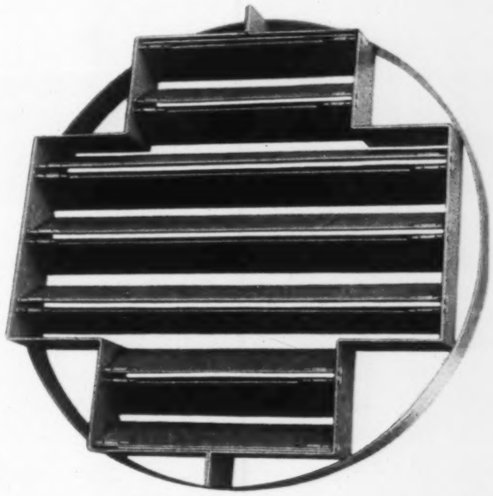
BARBER-COLMAN

GRILLES & REGISTERS
AIR DIFFUSERS

ENGINEERED
Uni-flo
GRILLES AND REGISTERS
AIR DISTRIBUTION

AUTOMATIC
CONTROLS

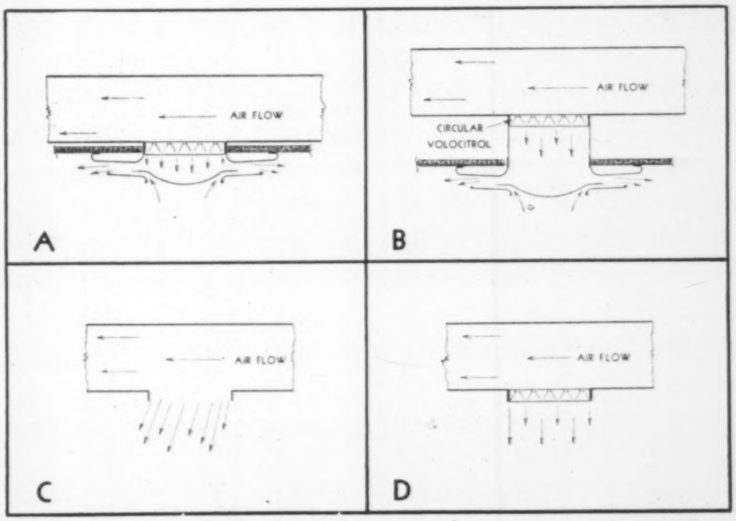
AN INEXPENSIVE, TIME-SAVING DEVICE FOR BALANCING CEILING OUTLET SYSTEMS OF AIR DISTRIBUTION . . .



Circular

VOLOCITROL

This VOLOCITROL affords an accurate and fully adjustable control of air flowing from a duct directly into a ceiling outlet, or through a branch duct to the ceiling outlet. The blades can be set as desired to direct the air flow, to control its distribution across a branch duct, and to govern the volume. Write for additional information.



A. Installation with ceiling outlet on duct.

B. Installation with ceiling outlet on branch duct.

C. Unequal air flow without Circular Volocitrol.

D. Equalized air flow with Circular Volocitrol.

BARBER-COLMAN COMPANY
1228 ROCK STREET
ROCKFORD, ILLINOIS

25 YEARS' SERVICE TO THE INDUSTRY

ACME PRODUCTS

Refrigeration and Air Conditioning Equipment

HEAT EXCHANGERS
SUCTION LINE

INCREASES EXPANSION VALVE CAPACITY . . . PREVENTS LINE VIBRATION AND CHATTERING VALVES . . . OFTEN INCREASES COMPRESSOR CAPACITY . . . PREVENTS LIQUID RETURN TO COMPRESSOR . . . ELIMINATES SUCTION LINE SWEATING.

Sixteen Standard Sizes up to 180 Tons. Catalog No. 12

EVAPORATIVE CONDENSERS
All prime surface cooling coils. Copper or steel.
AMMONIA CONDENSERS
Shell and Tube—Horizontal or Vertical
FREON SHELL and TUBE CONDENSERS
Capacities 2½ to 450 Tons—Steel or Copper Tubes.
DIRECT EXPANSION WATER CHILLERS
Indirect Air Conditioning and Processing Water
FLOODED WATER CHILLERS
Drinking and Ingredient Water
HI-PEAK WATER COOLERS
Storage type, Direct Expansion
CASCADE WATER COOLERS
Aerator Type, Bottling Plants
BRINE COOLERS
Steel Tubing or Pipe
FINNED COILS
Air Conditioning—Low Temp.
PIPE COILS
Steel—½" to 2"
HEAT INTERCHANGERS
Refrigerant Suction Line—Liquid to Gas
OIL SEPARATORS
Separators—Not Traps
LIQUID RECEIVERS
Refrigerant
FORCED CONNECTION UNITS
Cold Dispensers
ACCUMULATORS
Refrigerant
SURGE DRUMS
Refrigerant
SHELL and TUBE HEAT EXCHANGERS
Liquid to Liquid—Gas to Gas, etc.

WRITE FOR CATALOG ON ANY OF THESE PRODUCTS

ACME INDUSTRIES
JACKSON • MICHIGAN

Critical comparison of these types, he said, shows that the steam system is heavy, unreliable in freezing temperatures, and requires frequent replacement of the boiler, but is safe and, with improvements in design, may be of use in the future airliner for humidifying the cabin air. The chief objection to the exhaust hot air heating system, the speaker explained, is the possibility of carbon monoxide gas entering the cabin. Still, he believes, the system is the simplest and most reliable in cold weather. The first type of combustion heater fails to start in cold weather and is short lived. A newer type employs a different combustion principle which makes it start readily at low temperatures. This heater is light in weight, has shown long life in ground endurance tests, and, with the addition of a light weight electric motor driven fan, will supply heat independently of the engines while the plane is on the ground.

New WPB Orders and Forms Affecting Heating, Piping, and Air Conditioning

The following has been taken from a compilation made each week especially for Victory Bulletin, issued by the Office of War Information, by the orders and regulations bureau of the War Production Board. Direct inquiries to E. Hamilton Campbell, chief, publications section, 3204 Building E, Washington, D. C. The information includes the order number, the modification, date issued, title, related forms (in some cases), the Federal Register citation, the WPB division, and the administrator.

L-38. Amendment 1. 5-28-43. Industrial and commercial refrigeration, air conditioning machinery, equipment. General Industrial Equipment. S. F. Smith.

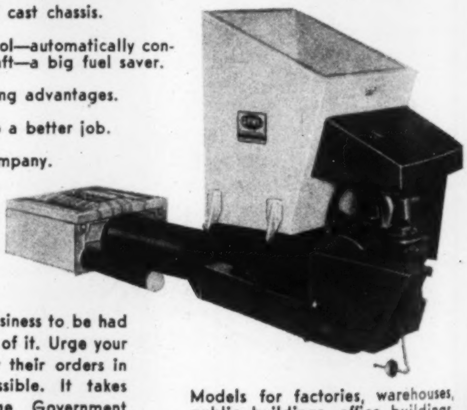
L-75. Amended. 5-28-43. Coal stokers. Plumbing and Heating. H. S. Norris.

L-126. Schedule 2 amended. 6-17-43. Refrigeration condensing units. 8 FR 8349. General Industrial Equipment. F. B. Millham.

L-216. Schedule II. 5-31-43. Wrenches. Tools. F. H. Zulauf.

GEHL STOKERS *will get you those* **HEATING PLANT CONVERSION SALES**

- Rust-resisting, all cast chassis.
- Barometric Control—automatically controls chimney draft—a big fuel saver.
- Other sales-winning advantages.
- Engineered to do a better job.
- A 76-year-old company.



There's Stoker Business to be had—get your share of it. Urge your customers to get their orders in as soon as possible. It takes time to arrange Government priorities.

Models for factories, warehouses, public buildings, office buildings, schools and churches.

Write for catalog and our plan of dealer cooperation.

GEHL BROS. MFG. CO.
Established 1867 Dept. BG-830, West Bend, Wisconsin

A GEHL WINS FRIENDS WHEREVER IT GOES

L-246. Amended. 6-18-43. Pumps. General Industrial Equipment. F. J. Whelan.

L-250. Interpretation 1. 6-8-43. Electric motor controllers. 8 FR 7652. General Industrial Equipment. C. G. Skidmore.

M-28. Amended. 6-5-43. Chlorinated hydrocarbon refrigerants. 8 FR 7760. General Industrial Equipment. F. W. Smith.

M-38. Amended. 5-26-43. Lead. 66A, 124. 8 FR 7007. Tin and Lead. S. K. Butterworth.

M-38-a-i. Revocation. 5-26-43. Lead. 8 FR 7008. Tin and Lead.

M-43. Amended. 5-25-43. Tin. 8 FR 6923. Tin and Lead. R. F. Segur.

M-43-a. Revocation. 5-25-43. Tin. 8 FR 6925. Tin and Lead.

M-330. Supplement 1. 6-16-43. Farm supplies (valves and pipe fittings). 8 FR 8265. Farm Machinery, Equipment. G. Krieger.

U-1. Amended. 5-31-43. Electric, gas, water, and steam utilities materials. 8 FR 7251. War Utilities. P. B. Vaille.

Symposium on Radiography

A 265 p. book, Symposium on Radiography, issued by the American Society for Testing Materials, includes 18 technical papers presented by outstanding authorities. The major part of the book includes the technical contributions in the 1942 symposium, but an important part is the collection of 1936 papers, several of which have been extensively revised, some condensed. Issued through the work of a special group of ASTM committee E-7 on radiographic testing, the symposium has as its basic purpose the development of better understanding of radiographic tests and their significance on the part of both the consumers and producers of materials.

There are extensive contributions on principles of radiography; foundry applications; miscellaneous applications; gamma ray radiography, with instructions for using radium; and the problem of inspection. Other topics covered in-

YARWAY
STRAINERS
"Police the Pipelines"

YARWAY STRAINERS are *selling by the thousands* because they are better engineered for the service.

"*The Screen is the Thing*"—a high-grade, woven Monel wire screen that stops the dirt, lets fluids flow freely.

Then too, purchasers like the *body finish—Cadmium plating inside and out* for protection against corrosion.

And last but not least, it is "*Easy to Clean*" having a steel blow-off bushing, precision machined with straight thread. Screen and bushing come out together — go back together, automatically aligning.

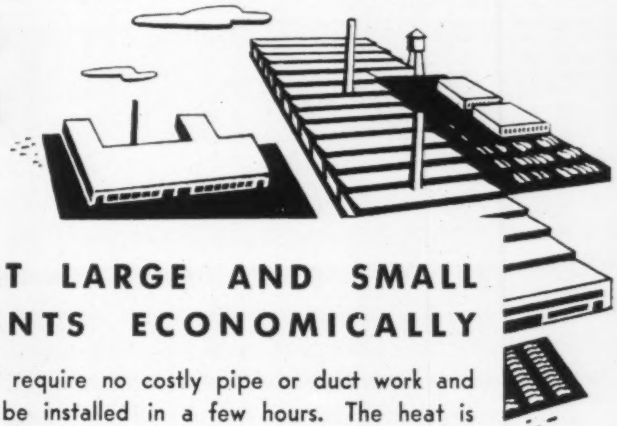
Six sizes, ½" to 2" for pressures up to 600 lb serve practically all strainer needs.

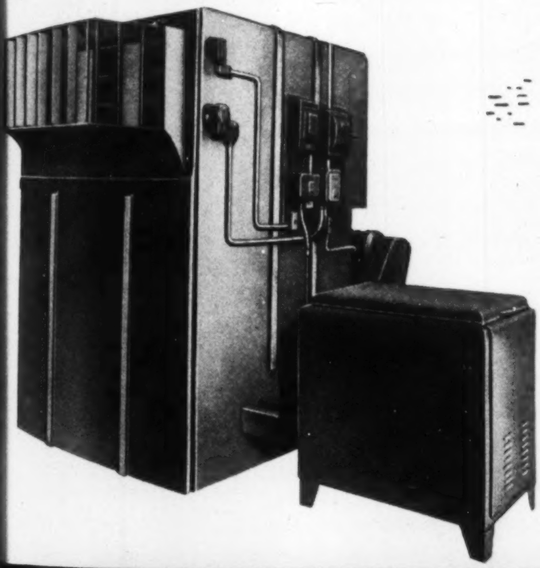
Sold by over 100 Mill Supply Houses. See your Supply House or write for Bulletin S-200.

•

YARNALL-WARING COMPANY
107 Mermaid Ave. PHILADELPHIA

DIRECTHERM
UNIT HEATERS





HEAT LARGE AND SMALL PLANTS ECONOMICALLY

THEY require no costly pipe or duct work and can be installed in a few hours. The heat is evenly distributed and thrown out as far as 200 feet. About 80% of the fuel energy is utilized.

Directherm Unit Heaters do not require any maintenance. All you need is to set the automatic controls.

For coal, gas, and oil.
Made in 6 sizes (300,000—1,700,000 BTU).

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. • ST. LOUIS, MO.

clude applications to production problems; welds and weldments; magnesium aircraft castings; correlation of mechanical properties and radiographic appearance of magnesium alloy castings; million volt portable unit; high voltage x rays in the boiler shop; welded high pressure power plant piping; apparatus used in radium radiography; exposure meter; study of cassette design; precision radiography; x ray film evaluation; industrial x ray protection; and recommended industrial radiographic terminology.

Special coated stock has been used to bring out the some 175 illustrations used in the book. Copies of this publication in red cloth binding 6 x 9 in., can be obtained from ASTM headquarters, 260 S. Broad St., Philadelphia, Pa., at $4.00 each.

Postwar Planning Forum

Highlights of the proceedings at a postwar forum, held in Syracuse, N. Y., under the sponsorship of Carrier Corp., are now available in printed form, according to an announcement by J. M. Bickel, moderator of the forum and chairman of Carrier's postwar planning group.

Contained in a 16 p. booklet, entitled Now is the Time . . ., are edited proceedings of the forum, held May 6 and 7, and attended by representatives of 20 leading American companies. A previous forum, bringing together a different group of industries, was held under the same sponsorship in January.

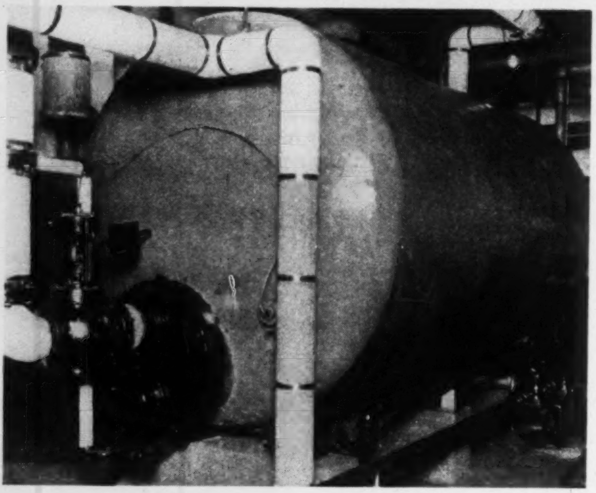
In the foreword to the booklet Mr. Bickel writes: "Although the term 'postwar planning' has captured the imagination of America, it means, in the final analysis, nothing other than what good business men have always been doing—preparing for the future."

Copies of the booklet are available on request from Mr. Bickel, Carrier Corp., Syracuse, N. Y.

List of American Standards

The American Standards Association, 29 W. 39th St., New York, N. Y., announced publication last month of its new List of American Standards which will serve as a

Handle Sudden **PEAK LOADS** *Without Excessive use of Steam*



WHITLOCK
PROCESS WATER HEATERS

All the clean, hot water required—with the least possible drain on fuel

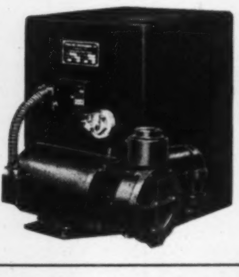
—that's what WHITLOCK calls a satisfactory hot water supply—the kind that WHITLOCK Storage Heaters provide—and have been providing for years.

Hundreds of industrial plants, as well as hotels, laundries, offices, clubs, schools and colleges and hospitals the country over depend on WHITLOCK Storage Heaters for their satisfactory hot water supply.

Ask for your copy of Bulletin 40 describing these Type K Heaters.

The WHITLOCK MANUFACTURING COMPANY
44 South Street, Elmwood, Hartford, Conn.
District Offices in New York, Boston, Chicago, Philadelphia, Detroit, Richmond

Quick Delivery
EXPLOSION-PROOF
Condensate Pumps



We can promise you IMMEDIATE DELIVERY from stock on Sterling EXPLOSION-PROOF CONDENSATE PUMPS, in varying sizes and capacities! And many sizes of Standard Condensate Pumps are also available for shipment on short notice.

Take advantage of this NOW for important replacements. For further information and quotations, write

Sales Department **STERLING, INC.**
4015 N. OAKLAND AVE., MILWAUKEE, 11, WISCONSIN

useful reference piece to the engineering and purchasing departments of manufacturing firms. It may be had on request to the ASA.

More than 600 standards are listed, 94 of which represent new and revised standards approved since the last (August, 1942) issue. These are marked with an asterisk.

Standards are listed by subject and cover civil, mechanical, electrical, mining, chemical and other engineering fields, as well as metals and materials, specifications of interest to the textile, wood, pulp and paper industry, methods of test for the finished product, dimensions, etc. They reach into every important engineering field and serve as a basis for many municipal, state, and federal regulations. By frequent review these standards are kept abreast of new developments in the fields to which they relate.

Pressure Losses in Registers

Warm air registers serve not only to conceal the opening out of which air is delivered from a duct, but may also serve to regulate the flow, direct the air stream, and distribute the air delivered into a space or enclosure.

The main objectives of the investigation described in Bulletin No. 342, Pressure Losses in Registers and Stackheads in Forced Warm Air Heating, by Alonzo P. Kratz and Seichi Konzo, which has been issued by the Engineering Experiment Station of the University of Illinois, were (1) to study the pressure gradients existing in the air stream on both sides of a register, and to derive a significant index for evaluating the pressure loss of the register; (2) to determine the effect on the pressure loss of varying the size of borders on registers; (3) to determine pressure losses for air outlets of various types; (4) to determine the pressure losses with registers attached either to the end of a straight duct, or to a stackhead; (5) to determine the effect on pressure loss of placing turning vanes in the stackhead; (6) to determine the effect on pressure loss of varying the relative sizes of registers and stackheads.

POWERS

INDICATING
and
RECORDING THERMOMETERS

Some of the many different types of Dial Indicating and Recording Thermometers we make are shown here. We also make Recording Regulators and Regulators combined with easy to read Indicating Thermometers. **Write for Bulletins.** Specify type of instrument in which you are interested.

THE POWERS REGULATOR CO.
2759 Greenview Avenue, CHICAGO
Offices in 47 Cities—See your phone directory

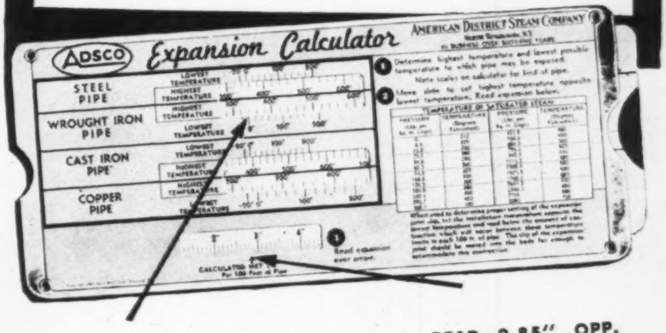
50 Years of Temperature and ★ Humidity Control ★

Get this ADSCO EXPANSION CALCULATOR FREE

● A simple, time-saving slide rule that shows expansion in 100 feet of pipe—for various materials and temperature ranges. Abbreviated steam table printed on face of calculator. No computations necessary — no handbooks — no chance of errors.

HERE'S HOW IT WORKS

Example How to find expansion in 140 feet Wrought Iron Pipe with highest temperature corresponding to 100 lbs. steam pressure (by gauge) and lowest temperature 0°.

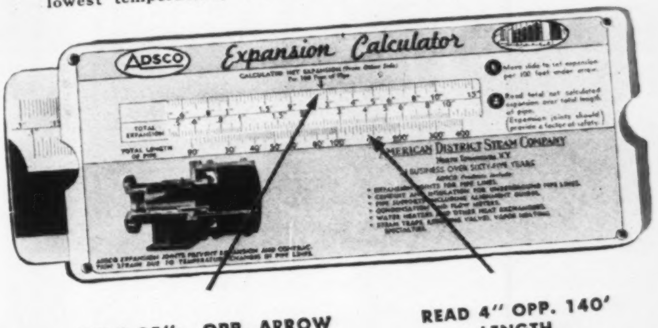


SET 3.40° OPP. 0°

Temperatures corresponding to 100 lbs. is a little less than 340° (340° = 103.3 lbs.) Set 340° (the highest temperature) on the slide opposite 0° (the lowest temperature) on the body.

READ 2.85" OPP. ARROW

Slot at bottom, opposite arrow reads 2.85 per 100 feet of pipe.



SET 2.85" OPP. ARROW

READ 4" OPP. 140' LENGTH

Turn calculator over. Set 2.85" (the expansion per 100 feet) on the slide opposite the arrow. Column marked "Total Expansion" reads 4" for 140 feet.

Its FREE *mail the coupon*

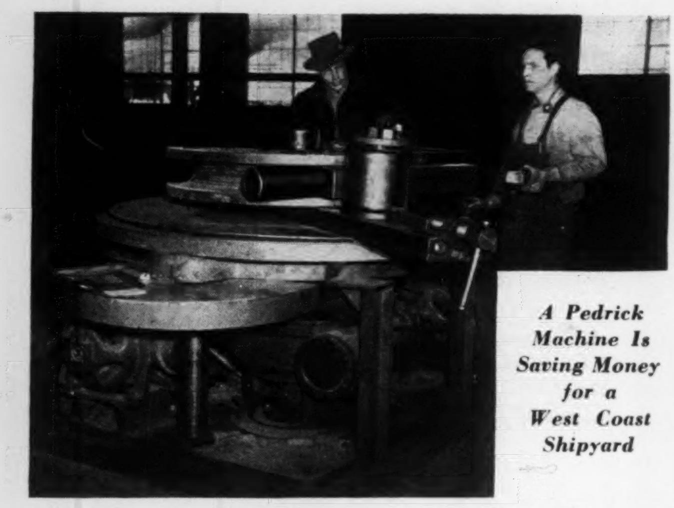
We will send you an ADSCO Expansion Calculator that will tell you HOW MUCH the expansion will be — also ADSCO Catalog that will tell you HOW TO PROVIDE FOR IT.

AMERICAN DISTRICT STEAM COMPANY, N. Tonawanda, N. Y.
• Please send me ADSCO Expansion Calculator—also ADSCO Expansion Joint Catalog.

Name ....

Company ....

Address ....



A Pedrick Machine Is Saving Money for a West Coast Shipyard

All Pedrick Pipe Benders Save You Money!

Write for literature showing how a piping job fabricated on Pedrick Machines is cheaper, stronger and quicker to install than other types of piping systems.

PEDRICK TOOL & MACHINE CO.
3640 N. Lawrence Street Philadelphia, Pa.

*Downright DEPENDABILITY *for day after day, year after year service*... Proved by thousands of users everywhere

FIRE-GUARD
Automatic Coal Stokers

Industrial Sizes: 70, 100, 150, 200, 300 and 400 pounds per hour capacity
--*also built in domestic sizes*

PEERLESS MFG. CORP.
INCORPORATED
Louisville, Ky.

Commercial stock registers were used for most of these tests, and the measurements of pressure loss were made primarily with the object of establishing design factors by obtaining general relationships between pressure losses and various features of construction. Such design factors would be useful in the development of registers characterized by minimum pressure losses.

Until December 1, 1943, or until the supply available for free distribution is exhausted, copies of this bulletin may be obtained without charge upon application to the Engineering Experiment Station, Urbana, Ill.

Studies in Arc Welding

New information on arc welding of interest and value in war production and with many important peacetime applications is soon to be made available by the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, in the form of a 1200 p. book containing 98 of the outstanding award studies submitted in the foundation's 1940-1942 industrial progress award program, according to announcement last month.

This volume, entitled, Studies in Arc Welding, will make available the accumulated knowledge and experience of more than 100 engineers, designers, and others applying themselves individually to a specific design study involving arc welded construction.

While the vast majority of the studies to be published involve products of plants engaged in war production, the principles and practices reported in the individual papers will be of value in postwar uses of the arc welding process.

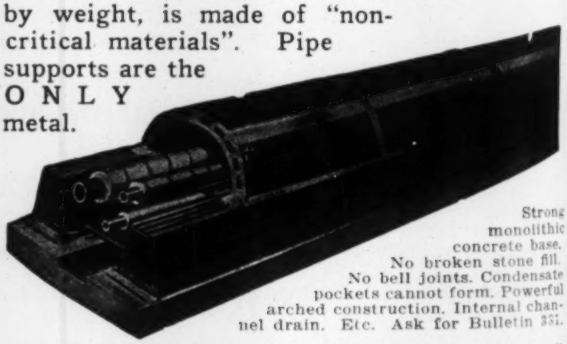
Oil Engine Power Costs

Executives and engineers concerned with the problem of economic power supply for industrial plants will find authoritative and useful data on cost of operation of diesel engines in the Report on Oil Engine Power Cost for 1941. This report, compiled annually since 1929 by a subcommittee of the oil and gas power division of the American Society of Mechanical Engineers, 29 W. 39th St., New

An Underground Pipe Conduit Made of "Non-Critical Materials"

THERM-O-TILE
Reg. U. S. Pat. Off.

As an aid in winning this war Therm-O-Tile is a very close approach to perfection because more than 98% of the entire conduit, by weight, is made of "non-critical materials". Pipe supports are the ONLY metal.



Strong monolithic concrete base. No broken stone fill. No bell joints. Condensate pockets cannot form. Powerful arched construction. Internal channel drain. Etc. Ask for Bulletin 381.

Sold and installed by Johns-Manville Construction Units in all Principal Cities. See our page in Sweet's or The Heating Guide.

H. W. PORTER & CO., Inc.
822H Frelinghuysen Ave., Newark, New Jersey

Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

Clip your name, firm, and address to this ad; tear out with the checked squares above, mail, and you will hear from us promptly.

York, N. Y., has become internationally known as an impartial and accurate source of information on such matters as fuel and lubricating oil consumption, and cost of supplies, maintenance, repairs, and supervision.

Copies are available from the ASME for $1.25.

Loss of Head Through Valves

Much of the information that is available concerning loss of head in valves was published over 20 years ago, and there are few published results of tests covering small valves of recent manufacture. The tests reported in bulletin No. 340, Loss of Head in Flow of Fluids Through Various Types of 1½ In. Valves, by Wallace M. Lansford, which has been issued by the Engineering Experiment Station of the University of Illinois, were made on twenty-nine 1½ in. brass valves of various types, namely, gate, globe, check, and Y valves, all of which were of the threaded or screw fitting type.

The dimensionless parameters used in this study were K_v, the ratio of the head loss in a valve to the average velocity head in the pipe, and R_p, the Reynolds number for the flow conditions in the pipe. These dimensionless parameters introduce all factors that influence the flow through the valves, and make it possible to express the laws governing the flow in a form that is independent of the units used. This permits the extension of the results of these tests to the flow of any fluid through all valves that are geometrically similar to those tested.

The loss of head in all the valves tested varied (closely) as the square of the average velocity in the pipe. This velocity ranged from a minimum of less than 1 fps to a maximum of more than 50 fps, depending on the type of valve.

The loss of head due to a 1½ in. gate valve wide open was nearly the same as the loss of head per foot in 1½ in. galvanized pipe; the loss of head due to a gate valve one-half open was approximately 25 times the loss of head when the valve was wide open, the velocities being the same in the two cases. The loss of head in a globe valve wide

SAVE WITH SARCO
Water Blenders

Here is a simple, sturdy, thermostatic mixing valve of many uses.

It will mix hot and cold water to provide blended water at any desired constant temperature. When used in connection with gang showers or group wash basins, it preserves hot water storage and will often make unnecessary the acquisition of additional heater capacity.

It brings tempered wash water right to the point of use in dairies, packing houses, or sheet mills. It provides accurate proportioning control for photographic and X-ray film washing.

Used to recirculate a varying portion of the cooling water, it saves water and lubricating oil and protects Diesel engines, compressors, or condensers. On brine unit coolers, it provides an accurate, compact and inexpensive temperature control.

A special type is available also for submerged heating coils and tankless water heaters connected to heating boilers in large or small buildings, to prevent scalding hot water reaching bath room fixtures. Catalogs 700 and 800.

153

SARCO
SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
Sarco Canada Ltd., Federal Bldg., Toronto, Ont.

GREEN LIGHT FOR INDUSTRY

*SARAN PLASTIC
PIPE, TUBING, FITTINGS

SARAN by HODGMAN is a tough thermoplastic specially made to replace strategic materials. It is adaptable for use under high working and bursting pressures and is resistant to most chemicals. Its ease of handling makes it extremely valuable in installations requiring the transport of oil, gas and corrosive chemicals.

*Pat. No. 2160931

Send FOR COMPLETE INFORMATION SHEET AND FREE SAMPLE

HODGMAN RUBBER CO.
FRAMINGHAM, MASS.

NEW YORK
761 Fifth Avenue

CHICAGO
412 South Wells St.

SAN FRANCISCO
121 Second St.

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

NoDrip **A SURE CURE**

● **This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition surfaces. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.**

Stucco-like finish requires no maintenance. A gallon covers about 30 feet of ½" pipe. Dries in 24 hours. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House.

FREE ***NoDrip Handbook. All about Condensation Drip and its Prevention.***

APPLY WITH BRUSH, TROWEL OR SPRAY

J. W. MORTELL CO.
Technical Coatings Since 1895
512 BURCH ST. KANKAKEE, ILL.

NEVER HARDENS...

PIPES ALWAYS EASY TO DISJOIN

Rutland is the Pipe Joint Cement that master piping contractors and plant engineers swear by—not at. It seals joints tightly—lasts indefinitely. Saves money because more bulk per pound. Legal for use in all cities because no toxic ingredients. Remains soft in can. Does not stain hands or fixtures.

Mail post card for free sample. Rutland Fire Clay Co., Dept. H-16, Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

RUTLAND
PASTE PIPE JOINT CEMENT
RUTLAND FIRE CLAY CO.
RUTLAND, VT.

GENERAL CONTROLS

K-3B

- Available in widest range of sizes, from 3/8" to 6" I.P.S.
- For operating pressures up to 5 pounds.
- Unusually low in current consumption.
- For all voltages and frequencies, A.C. or D.C.
- Quiet, positive and trouble-free operation.

INDUSTRY'S FIRST CHOICE SINCE '31

General Controls' K-3B is a versatile magnetic gas valve. It has a wide acceptance for use in controlling gas to heat-treating ovens, boilers, furnaces, and similar industrial installations. Write for Catalog 52 for full description specifications.

GENERAL CONTROLS
801 ALLEN AVENUE • GLENDALE, CALIFORNIA
Branches: Boston • New York • Philadelphia • Cleveland
Detroit • Chicago • Dallas • Denver • San Francisco

open was about 40 times, and the loss of head in a Y valve wide open about 20 times that in a gate valve wide open, the velocities being the same in all cases. The loss of head caused by check valves varied greatly, depending on the type of the mechanism. The Reynolds numbers used varied from less than 20,000 to more than 500,000.

Until December 1, 1943, or until the supply available for free distribution is exhausted, copies of bulletin No. 340 may be obtained without charge upon application to the Engineering Experiment Station, Urbana, Ill.

Effect of Cold Drawing On Welded Steel Tubing

A thin walled hollow cylinder, commonly referred to as "tubing," has many inherent advantages as a load resisting or structural member because of the shape or distribution of the material in the cross section.

Although engineers have long been aware of the latent possibilities of tubing for structural members, the cost of

By the best authorities

HEATING, PIPING
&
AIR CONDITIONING
6 N. Michigan Avenue,
Chicago 2, Ill.

Good, sound, practical information which will help greatly in simplifying your work and which is written by the industry's best authorities. This best describes the contents of every issue of HEATING, PIPING & AIR CONDITIONING.

To be thoroughly informed subscribe today. Two Dollars a year.

It's Easy TO SPOT DIRT CLOGGED FILTERS with a HAYS AIR-FILTER GAGE

0-1 2 3 4 5
HAYS

Of course you know that air-filters must be cleaned or replaced, but when? The Hays Air-Filter Gage tells you exactly when dirt clogged filters are obstructing air flow, impairing operating efficiency, increasing power costs. The gage is easy to install . . . nothing to get out of order. It has been recommended by engineers for nearly half a century. Write 990 Eighth Ave., Michigan City, Ind., for A-F G. Bulletin and prices.

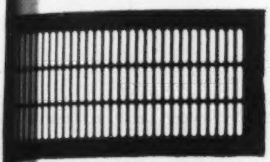
The HAYS CORPORATION
SINCE 1901 COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, USA

production and the difficulty of obtaining economical and efficient connections between members have restricted its use; but there is at present a growing attention being given to the use of tubing, especially where a large strength-weight ratio is desired, as, for example, in certain types of airplane construction.

There seem to be no published data giving quantitatively the effect of cold drawing on the properties of welded steel tubing, and any attempt to impart special properties to tubing by this process seems to be done by trial and error methods.

The purpose of the investigation described in bulletin No. 341, Effect of Cold Drawing on Mechanical Properties of Welded Steel Tubing, by Winston E. Black, which has been issued by the Engineering Experiment Station of the University of Illinois, was to evaluate the changes that occur in the more common mechanical properties of elec-

War Products Come First!



Auer is now engaged principally on vital aircraft parts and other war-time products. We are still able to furnish most styles of registers from inventory stocks, for all purposes permitted by Federal regulations. We are also well equipped for sub-contracts on metal stamping and fabricating, in gauges 10 to 24, and invite your inquiry on priority war goods.

Auer Register Book sent on request.

HE AUER REGISTER COMPANY, Cleveland, O.

AUER REGISTERS
GRILLES · For Air Conditioning *and* Gravity

PERFORMANCE PLUS with *Economy* SCV *Pumps*

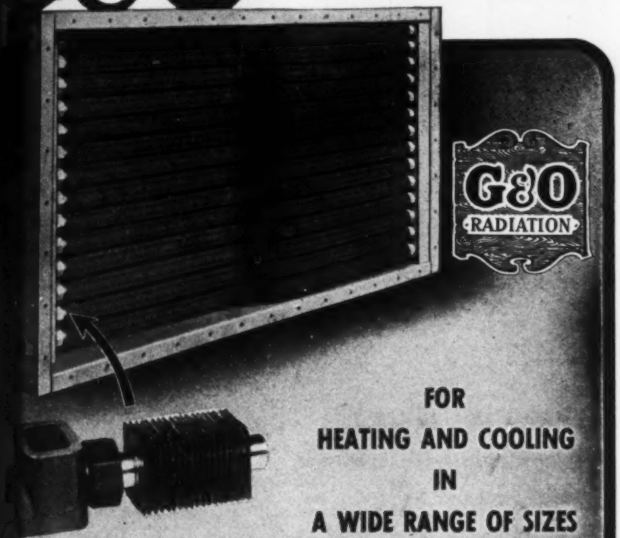
Economy's new vertical type pump for clear liquid services. Highly recommended for hot and cold water circulation, air conditioning systems, brine circulation, sprinkler equipment, boiler feeding, pressure boosting, etc.

- ● Vertical in design—saves floor space.
- ● Motor high and dry—away from splash and dirt.
- ● Complete rotor easily removed without disturbing piping connections.
- ● Impeller keyed to extra heavy shaft rotates between both an outboard and inboard bearing—smooth and noiseless operation.
- ● Built in sizes with discharges 1" to 3", for capacities from 10 to 500 GPM, with heads up to 225 feet.

Write for fully illustrated and complete descriptive Catalog No. D2-1042.

ECONOMY PUMPS, INC.
1011 WELLER AVENUE — HAMILTON, OHIO

G&O COILS



FOR HEATING AND COOLING IN A WIDE RANGE OF SIZES

●

Send for Catalog

●

Detail of mechanical joint used in Universal Heat Transfer Coils.

HE G&O MANUFACTURING COMPANY
New Haven, Connecticut
oneer Manufacturers of Square Finned Tubing in the United States

DE-STA-CO

Blower Wheel Housings

of Standard Dimensions

Made in sizes to fit 4½, 5, 6, 7½ and 9 inch wheels and in widths to suit single or double inlet wheels . . . also individual parts for your own assembly.

De-Sta-Co housings are engineered for maximum efficiency and quietness in operation . . . neatly finished. Send for "De-Sta-Co Blower Housings" bulletin; gives complete information, including essential dimensions.

DETROIT STAMPING CO.
Established Over 25 Years
337 Midland Ave • Detroit, Mich.

trically welded, low carbon (SAE 1010) steel tubing as a result of cold drawing the tubing.

It was intended thereby not only to aid the manufacturer in producing tubing of known properties, but also to furnish information, for use in structural design, on the strength and ductility of such low carbon welded and cold drawn steel tubing.

Experimental results of tension, compression, and hardness tests of samples of SAE welded steel tubing are presented in the bulletin. The tubing from which the samples were taken, as originally formed (welded and normalized), had an outside diameter of approximately 1 in., and had been subjected to various amounts of cold working by drawing through dies of different diameters. Tests were made both on the normalized tubing before being cold drawn, and on the cold drawn tubing. The structural behavior of members, machines, or structures made of the tubing is not discussed in the bulletin.

Until December 1, 1943, or until the supply available for free distribution is exhausted, copies of bulletin No. 34 may be obtained without charge upon application to the Engineering Experiment Station, Urbana, Ill.

To Speed Victory!
WE ARE READY TO SERVE YOU!
"American"
COLD PIPE, CONDUIT and TUBE BENDING MACHINES

Twelve types to select from. Hand operated capacities ¼ to 6" inclusive. Motor operated ¾ to 8" inclusive.

A few of our More Than 12,000 Customers: Kaiser Shipbuilding Co.; Bethlehem-Hingham Shipyards; Portsmouth Navy Yard; Moore Drydock Co.; Stone & Webster Engineering Corp.; E. I. Du Pont de Nemours & Co.; West Penn Power Co.; Illinois Central Railroad; Federal Pipe & Supply Co.; Alabama Drydock Co.; Westinghouse Elec. & Mfg. Co.; Todd-Bath Shipbuilding Co.

Write Air Mail for printed matter.

"American"
PIPE BENDING MACHINE
Company INC

Quick Deliveries
51 PEARL ST.
BOSTON, MASS.

HYDRON
Metal Bellows

HYDRON
METALLIC BELLOWS

We manufacture HYDRON bellows and bellows assemblies ready for installation in steam traps, relief valves, temperature regulators, pressure regulators, air valves, and automatic temperature and pressure controls, including aircraft engine cooling systems, carburetors, and super-chargers. We also manufacture HYDRON extruded tubing for aircraft prestone radiators, oil coolers, inter-coolers, and after-coolers, for liquid-cooled and air-cooled motors.

CLIFFORD MANUFACTURING CO.

CHICAGO
221 N. LaSalle Street

564 East First Street
BOSTON, MASS.

DETROIT
6432 Cass Avenue

"ALNOR" VELOMETER
DIRECT READING AIR VELOCITY METER

"Alnor" Velometer fills the need for a simple, accurate means of determining air velocity in air conditioning, forced air exhaust ducts, etc. Peak efficiency operation is now more important than ever before . . . and Velometer with its many simple attachments assures correct readings, under the most adverse conditions, in feet per minute, right on the scale! These readings enable you to gauge the systems efficiency and MAKE NECESSARY ADJUSTMENTS to assure greatest efficiency. Write for new catalog now!

Illinois Testing Laboratories, Inc.
412 N. La Salle St., Chicago, Ill.

The ENEMY of
- SCALE
- RUST
- SLIME
- DIRT
- ALGAE

SOL-VET "08" is a fast, efficient cleaner of all equipment using water for cooling. By dissolving impurities *completely*, they are carried out *in solution*, thus preventing clogging. Head pressures fall to normal; heat transfer is raised to maximum; full circulation is restored; life of equipment prolonged. On large jobs, shutdown time is cut to a maximum of 6 to 8 hours.

GUARANTEED EFFECTIVE If you find SOL-VET "08" is not exactly as represented, when used according to instructions and full, accurate report is given within 30 days from date of purchase, your money will be *refunded in full.*

GUARANTEED HARMLESS when used as directed, to all water conducting materials used in water cooled equipment.

WRITE TODAY for complete data and analysis and recommendations for your specific problems.

SOL-VET "08"
Water Treatment Formula
MANUFACTURED and GUARANTEED by
ANDERSON-STOLZ CORPORATION
1733 WALNUT STREET • • • KANSAS CITY, MISSOURI

Equipment Developments

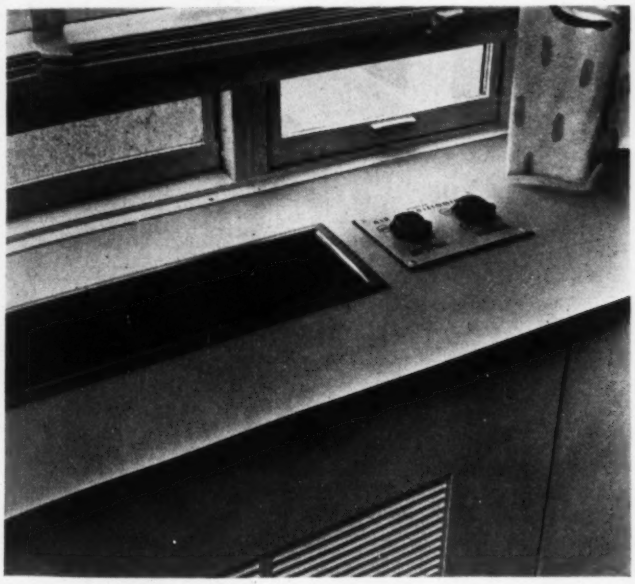
For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1943, Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.

Conduit Air Conditioning System Serves New Hotel Statler

No. 2466—First hotel in the world to install the "Conduit Weathermaster" system of air conditioning, whereby each guest can create his or her own indoor weather conditions, is the new Statler in Washington, D. C.; it also has the distinction of being the first large hotel which was planned and constructed to include year 'round air conditioning in the entire hotel. All guest rooms, public rooms, and corridors are air conditioned, as are many of the working departments.

Nine hundred and thirty-one units are supplied with conditioned air at high velocity through relatively small pipes, eliminating the need for ducts. This feature of the system resulted in the saving of space equivalent to two extra floors in the hotel.

Windows are kept closed, always, with resulting elimination of outside noises and dirt. The air outlets serve as an "open window" at all times, bringing air directly from outdoors. This air is conditioned for temperature, humidity, and cleanliness.



In each guest room the air conditioning unit, simple and inconspicuous in design, is directly beneath the window sill. A grille on the top of the sill diffuses air to all parts of the room, eliminating objectionable drafts. Air is made warmer or cooler by adjustment of a simple dial, while the humidity in the room is controlled from the central air conditioning plant at the top of the building, where outside air is taken in high above the street. Before the outdoor air reaches the room outlets it passes through a fine filter and is washed. The air from each room goes directly to the outdoors through the exhaust outlet on the bathroom wall.

Another interesting and novel feature of the air conditioning in the guest rooms is the quiet operation of the air conditioning equipment units. There are no moving parts. Looking down through the grille work, one can see a series of nozzles. As the air, at high velocity, comes through these nozzles it is expanded so as to reduce velocity without noise. From that point it passes through a secondary conditioning system which is enclosed beneath the window sill. Here is a finned water coil through which circulates hot or cold water, depending upon temperature requirements.

The air passes over these coils and then is directed upward into the room itself by baffles which are so arranged that the air flow will not touch the occupant of the room no matter where he or she may be.

The individual units are connected to two 550 ton centrifugal refrigeration machines. These refrigeration machines also serve the public rooms in the hotel.

The air conditioning system for the guest rooms is arranged in four zones, so that the required cooling will be available to take care of varying summer heat conditions and especially those caused by exposure of different portions of the building to the sun's rays at different times of the day.

The steam generating plant of the hotel, used for laundry,

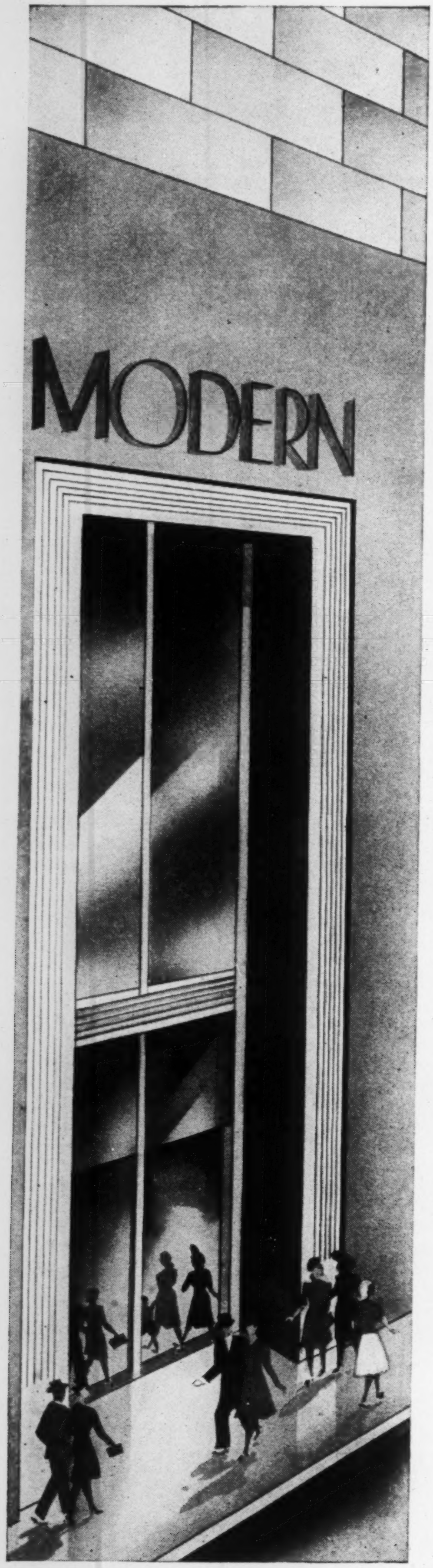
Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago, Ill. [8-43]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature.

(Circle each number in which you are interested):

2466 2467 2468 2469 2470 2471 2472 2473
4495 4496 4497 4498 4499 4500 4501 4502 4503 4504
4505 4506 4507 4508 4509 4510 4511 4512 4513 4514
4515 4516 4517 4518

Name.............................. Title..............
Company ....
Address ....
City.............................. State...........



Fine Stores will have Fine Air Conditioning in 194?

Air Conditioning
WORTHINGTON
REFRIGERATION

It is the "air" of a store which determines its clientele. What has long been just a figure of speech will become a literal fact in the future—the post-war future.

Air Conditioning of shops—small and large alike—is coming as surely as popular preference for air travel. Only the circumstance of war delays it.

Worthington engineering is pointed toward that day. The technical knowledge now applied to the creation of super-stratosphere conditions for aviation engine testing will move on to peace-time accomplishments. Better, more adaptable and economical Air Conditioning units will result. They will be one of the beneficial by-products of war.

Business, like industry, will reap the rewards. For Air Conditioning has already proved itself a sales asset as well as a major factor in working efficiency. And through a nationwide network of Worthington Distributors it will be quickly available to all.

WORTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J.
District Offices and Representatives in Principal Cities

CA3-34

WORTHINGTON AIR CONDITIONING AND REFRIGERATION

Air Conditioning
WORTHINGTON
REFRIGERATION

Progressive Distributors will sell fine AIR CONDITIONING in 194?

DISTRIBUTOR
Air Conditioning
WORTHINGTON
REFRIGERATION

The message reprinted on the opposite page is addressed in magazines of national circulation to people all over America ...People who, in the midst of war's sacrifices, can pre-vision such peacetime comforts as Air Conditioning.

This vast public will be ready and eager for betterments in their way of life the day that victory is won. They must and will be served. And in communities everywhere, Worthington Distributors will be ready to install the mechanically superior Worthington Units even now being planned.

That they will be superior is beyond challenge. For out of the exhaustive and varied experience Worthington engineers have gained during the war, have been developed new ideas, and a new understanding of temperature and humidity control.

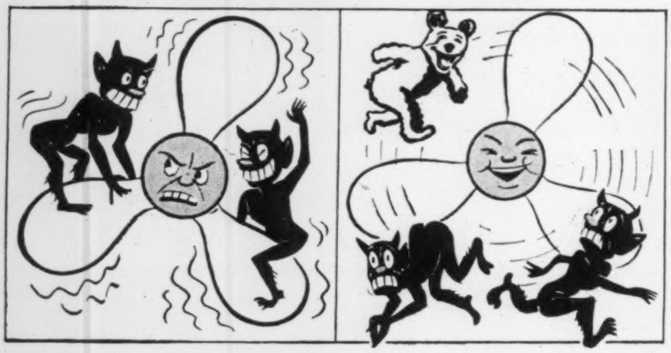
Far-sighted business planners will appreciate the importance of giving a little thought now to the significance of a Worthington franchise in the post-war years.

WORTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J.
District Offices and Representatives in Principal Cities

CA3-33

WORTHINGTON AIR CONDITIONING AND REFRIGERATION

Get rid of the "WOBBLIES"



with the new BEAR

DY-NAMIC BALANCING

Get Rid of Excessive Wear Vibration Noise caused by Couple-Force Action

Now it's simpler... much easier... less costly... to rid Fans, Blowers, Motors and all rotating parts of the wrecking, wasteful "Wobblies" of Dy-Namic Unbalance!

Leading builders of Air Conditioning and Ventilating Equipment report that Bear Precision Dy-Namic Balancing—

1. **Solves many production problems:** — Shortens time required to Dy-Namically Balance to accuracy of Government specifications. Ends manpower problems, as men and women are easily trained to operate the new Bear machines.
2. **Improves Product Performance:** — Prevents premature wearing out of fan bearing and shafts . . . Lessens need for adjustment and repairs . . . Lengthens life of motors . . . Eliminates power wastage.

Based on a new, different — but fully proven — principle, Bear Machines for Dy-Namic and Static Balancing are less complicated, easier to operate, lower in cost. Many models, types and sizes to meet various requirements.

WIRE, PHONE, or WRITE the details of your balancing problems, and write for **FREE DATA BOOK** showing the many Bear Machines available to those with war industry priorities. Address Bear Mfg. Co., Industrial Division. Dept. HPV, Rock Island, Illinois.

BEAR

COMBINATION

STATIC AND DY-NAMIC BALANCING MACHINES

kitchen, heating of water for domestic purposes and space heating, consists of two 354 hp and one 301 hp boilers operating at 125 psi pressure. Oil is used as fuel for the 301 hp and one 354 hp boiler and the other boiler is equipped with a stoker.

Steam is supplied through reducing valves to provide 100 psi pressure to laundry equipment, between 15 and 30 psi to kitchens, and 5 psi pressure to heating systems. Vacuum and boiler feed pumps are steam driven and designed for operation at 125 psi on the steam ends.

The heating systems are all automatically controlled with steam being used for heating of all air, direct radiation, and for heat exchangers on the forced hot water system serving the window units installed in all guest rooms.

All ventilating systems are designed to operate with 100 per cent outside air and heating coils are designed for this purpose using steam as the heating medium. All public rooms with outside exposures have convector type radiators. All entrances are heated by unit heaters and guest baths all have cast iron radiators.

Guest rooms are heated, as previously stated, by window units supplied with primary air. Primary air units are located in penthouse and consist of tempering coils, reheaters, filters, spray type dehumidifiers, and fans which distribute air through round ducts to guest rooms. Fans operate against a static pressure of 6½ in.

Forced hot water to guest room window units is split into four zones. Each zone consists of a heat exchanger, pump, and automatic controls to provide proper temperature water to each zone, and each window unit is equipped with a thermostatically controlled valve reset manually by guest.

Mehring and Hanson Co. as heating and ventilating contractor, installed the air conditioning system. Holabird and Root served as architects and consulting engineers, and John W. Harris Associates, Inc., was the general contractor. —Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Direct Fired Air Heaters for Dehydration and Chemical Processes

No. 2467—Output temperatures between 150 and 350 F with the heated air free from contamination can now be obtained from coal or oil burning direct fired heaters without the use of critical alloy steels, by a method recently developed.

These temperatures are obtained from heaters with carbon steel combustion chambers, by means of a recirculating

device. The recirculating principle allows heated air to be fed back to the heater's intake, so that the normal temperature rise obtainable by wiping air around a carbon steel fire box will produce any temperature up to 350 F, according to the percentage of the air that is recirculated, says the manufacturer. This percentage is regulated by a damper in the recirculating duct. To produce 350 F, 80 per cent recirculation is required.

Thus, these units can be used to meet the air temperature demands in many dehydrating and chemical processes. Saving of fuel as a result of high efficiency of heat abstraction and negligible radiation losses; quickness of installation; availability for quick shipment; flexibility of the installation as regards later plant extension; and the fact that skilled labor is not required for their operation are among their features. The heaters are available for oil, gas, or coal and heaters designed for coal can be converted to oil or gas when conditions make these fuels available after the war.—Dravo Corp., Neville Island, Pittsburgh, Pa.

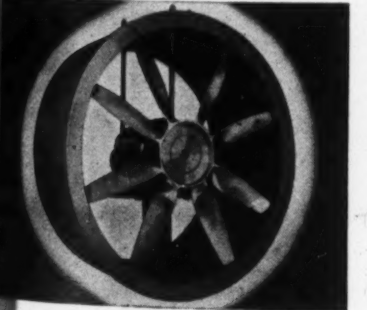
Pressure Switch Offered for Proportioning Control

PRESSURE SWITCH
SERIAL NO.
BARBER-COLMAN COMPANY

No. 2468—The micro pressure switch illustrated is offered for proportioning control of motor operated valves, power units, program switches, etc., for the regulation of steam, air, and gas pressures. Some of the many applications are control of steam boilers, automatically fired by proportioning type oil burners, gas burners, and stokers, suction pressure of multiple "Freon" compressors, and regulation of head pressures in liquid level control.

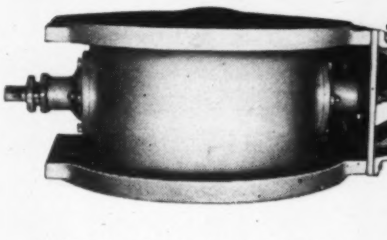
It is a single pole, double throw, three-wire instrument with positioning solenoid. The pressure sensitive bellows mechanism is mounted on a bakelite sub-base and enclosed in a metal case for surface mounting. A built in condenser protects the contacts. There is a convenient external adjustment, but the setting may be locked in place by means of internal locking screws.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

New Duct Fan Available for Direct or Belt Drive



No. 2469—A new duct fan is made in both direct connected and belt driven styles, the belt driven model being designed for use in ducts through which fumes which are a fire hazard or elements likely to damage the motor are carried. The equipment is simply a standard propeller fan built into a duct section at the factory to eliminate the time, expense, difficulties, and danger of mistakes when the job is done in the field. A flanged ring at each end of the fan duct section allows it to be quickly bolted to the duct in place of the section it replaces, and when the electrical connection is made installation is complete.

The new fan is made in sizes from 12



There's an
R-S DISTRIBUTOR
As Near as Your Telephone

▲ 125-lb valve equipped with control cylinder. Double end stuffing box eliminates end thrust.

15-lb Wafer Type (Narrow face-to-face construction). ▶

R-S QUALITY PRODUCTS SINCE 1908

15 to 900 psi

These R-S Distributors are valve specialists. They are experienced with the solution of problems encountered in the control and shut-off of air, gas, steam, liquids and semi-solids. Familiar as they are with the application of valves to high and low pressures, temperatures and volumes, they can frequently make suggestions that will simplify a valve installation and reduce costs.

Naturally, these local representatives are thoroughly familiar with the R-S development of special metals for resistance against heat, abrasion and corrosion.

Get acquainted. These valve experts are good men to know well.

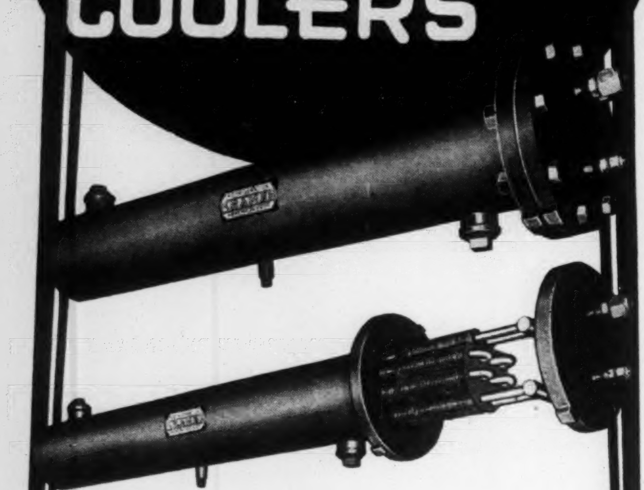
SHEFFLER-GROSS CO.
Drexel Bldg., Phila. Zone 6, Pa. Lombard 4900
J. F. HALLOWELL
Columbia Bldg., Pittsburgh, Pa. Court 5362
R. W. CRANE
37 Parkwood, Kenmore, N. Y. DElawr 8141
GEO. VAN VECHTEN
217 East Avenue, Rochester, N. Y. Stone 4164
ASHMEAD-DANKS CO.
Rockefeller Bldg., Cleveland, Ohio Main 6192
POWER PLANT EFFICIENCY CO.
Union Title Bldg., Indianapolis, Ind. Market 4617
H. T. PORTER COMPANY
1413 Union Central Bldg., Cincinnati, Ohio
Main 1299
W. P. NEVINS CO.
53 W. Jackson Blvd., Chicago, Ill. Harrison 1473
SPURGEON COMPANY
5050 Joy Road, Detroit, Mich. Tyler 7-2750
KRENZ & COMPANY
5114 W. Center St., Milwaukee, Wisc. Hilltop 2983
F. H. YOCUM-A. H. GOODE
Graybar Bldg., New York, N. Y. Murray Hill 5-3370
W. B. PARSONS CO.
10 High St., Boston, Mass. HUBbrd 4119
DOUGLAS FRAZIER
1524 So. Gary Place, Tulsa, Okla. 6-0384
POWER SPECIALTY CO.
1042 Mellie Esperson Bldg., Houston, Texas
Preston 5384

BUSHNELL CONTROLS & EQUIPMENT CO.
117 W. 9th St., Los Angeles, Calif.
Vandike 1359
BUSHNELL CONTROLS & EQUIPMENT CO.
Mills Tower Bldg., 220 Bush St., San Francisco, Calif.
Exbrook 1102
JOHN H. CARTER CO.
1013 Canal Bldg., New Orleans, La. Magnolia 1847
M. N. MUSGRAVE & COMPANY
2019 Third Ave., Seattle, Wash.
Eliot 4425
LYDON-COUSART COMPANY
304 Builders Bldg., Charlotte, N. C.
Phone 3-4481
KONE ENGINEERING CO.
11 W. 25th St., Baltimore, Md. Belmont 0138
RUSSELL PATTON
3020 Olive St., St. Louis, Mo. Franklin 2836
A. BURKS SUMMERS
411 Colorado Bldg., 14th & "G" Sts., N. W.
Washington, D. C. Republic 7231
GEO. F. HASTINGS CO.
1421 17th St., Denver, Colo.
Main 4585
GEO. R. MELLEMA
4234 Grimes Ave., So. Minneapolis, Minn.
Walnut 6984
G. E. JOHNSON & ASSOCIATE
Bona Allen Bldg., Atlanta, Ga.
Walnut 4571

VALVE DIVISION
R-S PRODUCTS CORPORATION
132 Berkley Street • Philadelphia 44, Pa.

R-S *Streamlined*
BUTTERFLY VALVES

KRAMER
COOLANT
COOLERS



THE design of the Kramer Coolant Coolers is based on actual tests made in the KRAMER laboratory.

Considerable study was made to obtain the proper ratio of primary and secondary surfaces in the cooling coil.

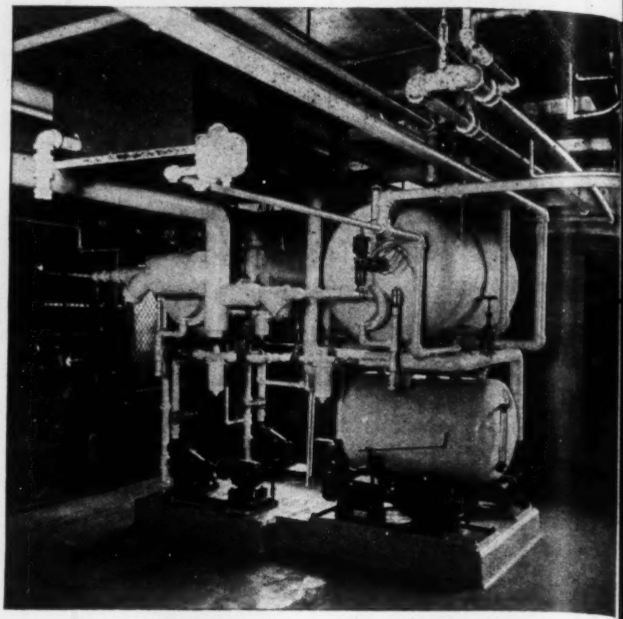
These units are designed for use with water, brine, or direct expansion refrigerant.

●

For full information, send for our Bulletin R-443 and Form R-243.

KRAMER-TRENTON CO.
Trenton, N. J.

COILS:
Bare Tube • Finned • Plate
CONDENSERS:
Air Cooled • Evaporative • Water Cooled
UNIT COOLERS:
Coolmaster • Freezing Oven (Electric Defrost)
Freezing Shower (Water Defrost)
AIR CONDITIONING UNITS • BLAST COOLING UNITS
BLAST HEATING COILS • COMFORT COOLERS • UNIT HEATERS
OIL COOLERS • COMBUSTION ENGINE RADIATORS
KRAMER SYSTEM (Balance Loader)



Power Plant Installation of Two Patterson Hot Water Storage Heaters

Peacetime Equipment
DESIGNED TO
Outlast the War
by PATTERSON-KELLEY

In power plants and war industries . . . on shipboard and in shipyards . . . in army camps and at advanced military bases, Patterson Hot Water Storage Heaters are "on active duty!" Many of them were installed before Pearl Harbor. And because these Patterson hot water storage units were constructed of durable materials according to exacting specifications, they are giving a good account of themselves — supplying hot water *when* it is needed, *where* it is needed and in the *quantities* needed.

Today, as in the past, Patterson-Kelley is building all types of heat exchange equipment — subject, of course, to W.P.B. allocations of strategic metals. If your preference rating — or that of your clients — does not entitle you to a new Patterson Hot Water Storage Heater, *extra* care must be taken to insure maximum trouble-free service from existing equipment. And that is where Patterson-Kelley *can* help you — *today*. Our engineers are available to you for free consultation on the care and conservation of all hot water installations. Why not drop us a line today?

EST. PATTERSON-KELLEY HEAT EXCHANGE ENGINEERS 1880

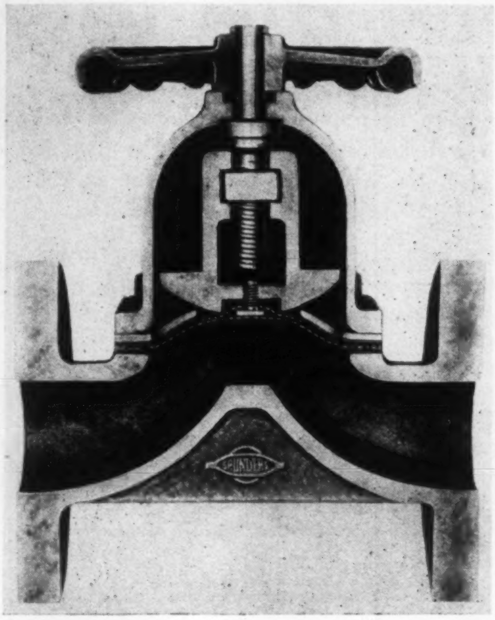
PATTERSON-KELLEY FOR DEPENDABLE ECONOMICAL SERVICE

THE *Patterson-Kelley* CO., INC.
107 WARREN ST., EAST STROUDSBURG, PA.

5 in. ring diameter and can be supplied with one pro- er, two propeller, and multiblade fans.—Hartzell Pro- er Fan Co., P.O. Box 909, Roosevelt Ave., Piqua, Ohio.

phragm Valves Have Frictional Resistance

o. 2470*—The "Grinnell-Saunders" diaphragm valve is by the manufacturer to be ideal for use in industrial ts, and nique in it re- res no ing me- parts in fluid eam. trol of fluid is com- hed by ns of a ilient phragm specially compound- d synthetics closing against a weir cast in the valve body. In the open position, the body and diaphragm form a smooth streamlined passage having the same cross-sectional area as the pipe. This results in low frictional resistance.



The valve body, bonnet, and parts, being made almost entirely of cast or malleable iron with very little machine work, conserve essential metals and machine facilities in production.

Corrosive fluids and suspended solids cannot impair the positive leakproof operation of this valve and the valve can cause no contamination of the fluid, says the maker. Valve bodies may be lined with glass, lead, or synthetic compounds to withstand corrosive or erosive action. These valves are used for compressed air, oil, water, chemicals, food products, pulp, and fluids containing solids.—Grinnell Co., Inc., 260 W. Exchange, Providence, R. I.

efrigerated Cargo Planes Predicted

No. 2471—Fleets of giant refrigerated cargo planes which will bring the world's produce to American dinner table hours instead of days after it has been gathered may be one of the early results of wartime advances in refrigeration and air conditioning, according to S. E. Lauer, president of the York Corp.

Super refrigerated air freighters are possible even now because of the higher efficiency of refrigerants and decrease in size of the equipment, a development brought on by military needs, Mr. Lauer said. Such new equipment, he added, will play a major role in solving the nation's food problem through greater production of quick frozen and dehydrated foods and storage facilities for preserving produce for indefinite periods.

In industry, air conditioning is an indispensable part of hundreds of delicate and exacting manufacturing operations for such products as optical lenses, electronics tubes, aircraft instruments, and chemicals. In performing this essential job, however, air conditioning has introduced a new form of working comfort which has stepped up efficiency and generally increased morale. In the modern

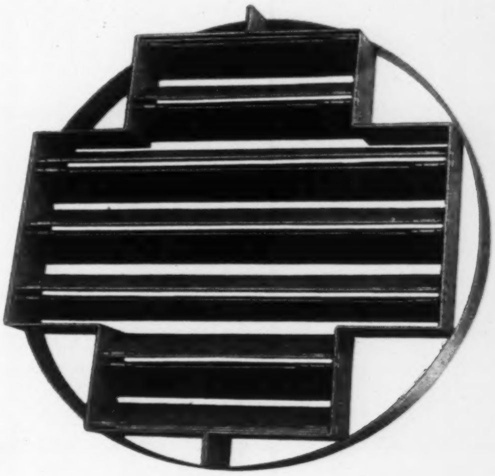
BARBER-COLMAN

GRILLES & REGISTERS
AIR DIFFUSERS

ENGINEERED
UNI-FLO
GRILLES AND REGISTERS
AIR DISTRIBUTION

AUTOMATIC
CONTROLS

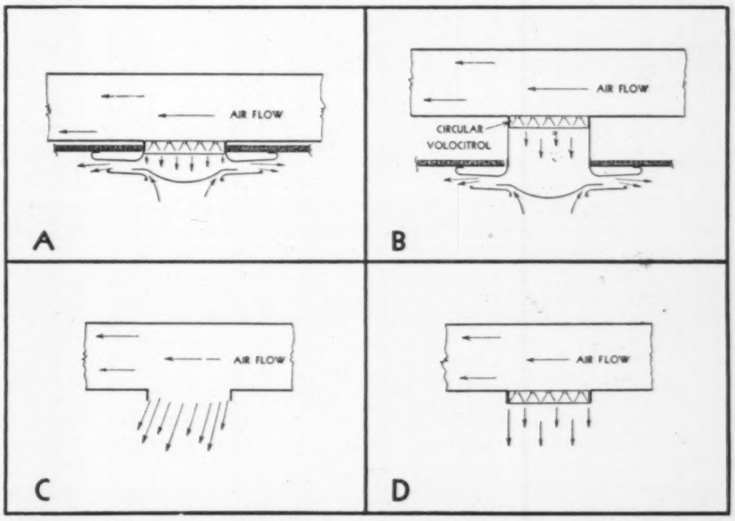
AN INEXPENSIVE, TIME-SAVING DEVICE FOR BALANCING CEILING OUTLET SYSTEMS OF AIR DISTRIBUTION . . .



Circular

VOLOCITROL

This VOLOCITROL affords an accurate and fully adjustable control of air flowing from a duct directly into a ceiling outlet, or through a branch duct to the ceiling outlet. The blades can be set as desired to direct the air flow, to control its distribution across a branch duct, and to govern the volume. Write for additional information.



A. Installation with ceiling outlet on duct.

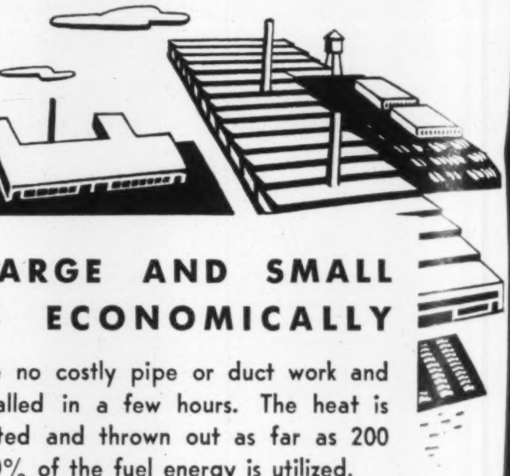
B. Installation with ceiling outlet on branch duct.

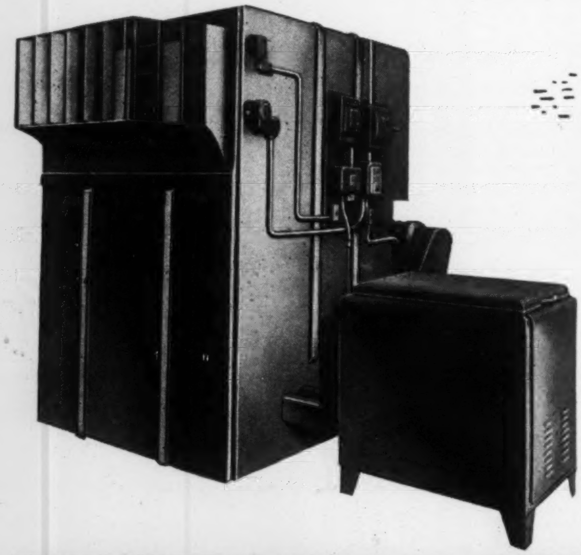
C. Unequal air flow without Circular Volocitrol.

D. Equalized air flow with Circular Volocitrol.

BARBER-COLMAN COMPANY
1228 ROCK STREET
ROCKFORD, ILLINOIS

DIRECTHERM
UNIT HEATERS





HEAT LARGE AND SMALL PLANTS ECONOMICALLY

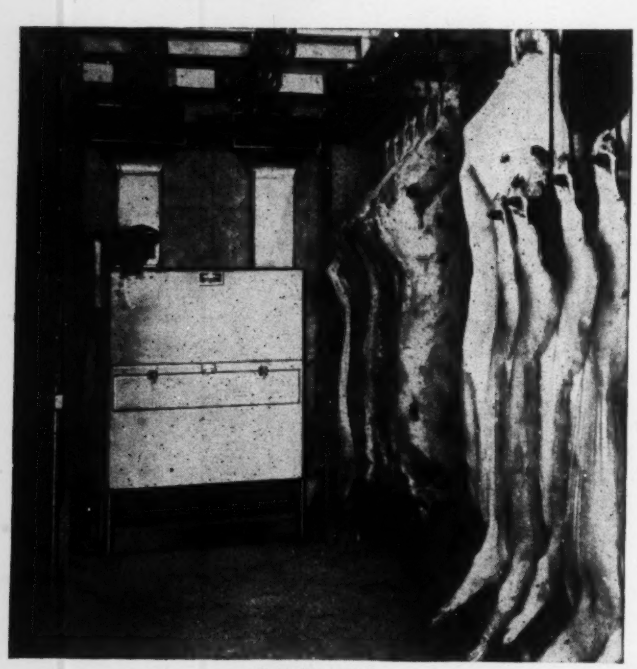
THEY require no costly pipe or duct work and can be installed in a few hours. The heat is evenly distributed and thrown out as far as 200 feet. About 80% of the fuel energy is utilized.

Directherm Unit Heaters do not require any maintenance. All you need is to set the automatic controls.

For coal, gas, and oil.
Made in 6 sizes (300,000—1,700,000 BTU).

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. • ST. LOUIS, MO.

Keeping Constant Low Temperatures in Refrigerated Rooms by the NIAGARA "No Frost" Method... *Saves* Compressor Capacity and Power



PATENTED

● The NIAGARA "No Frost" System provides a more reliable method for obtaining...

1. *Extreme low temperatures in cold room.*
2. *Greater economy in refrigerating large spaces below freezing temperatures.*
3. *More dependable control of temperatures for better handling of perishable foods.*

NIAGARA "No Frost" System eliminates icing of cooler coils and shut-downs for de-icing. It gives increased capacity from compressors and increased refrigerated space from the same compressor equipment. The NIAGARA "No Frost" Method has been thoroughly proven by practical experience for years of plant operation. Write for complete information and Niagara Bulletins 83 and 95. Address Department HP-83.

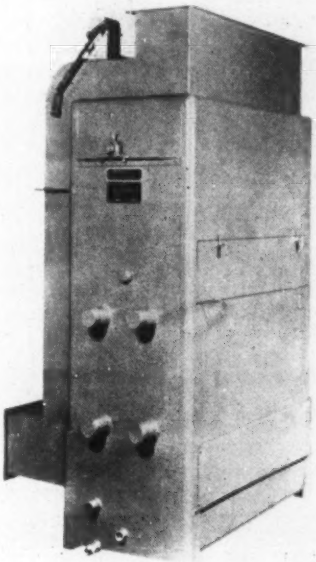
NIAGARA BLOWER COMPANY
General Sales Office: 6 E. 45th Street, New York City
37 W. Van Buren St., Chicago
Fourth & Cherry Bldg. Seattle
District Engineers in Principal Cities

NIAGARA INDUSTRIAL COOLING • HEATING • DRYING HUMIDIFYING • AIR ENGINEERING EQUIPMENT

factory and home of postwar years, air conditioning may well become standard equipment.

Mr. Lauer pointed out that refrigeration equipment has actually made possible mass production of such critical war products as synthetic ammonia, synthetic nitrates, high octane gasoline, and synthetic rubber. Refrigeration has also made possible the modern strato-chamber, almost universally used to test pilots and aircraft equipment at simulated stratosphere conditions.—York Corp., Roosevelt Ave., York, Pa.

Heat Exchanger for Industrial Process Temperature Control



No. 2472—A new development for adding heat to industrial liquids for the purpose of maintaining constant temperatures as desired, with automatic control, is announced for the "Aero" heat exchanger. This has not been previously done with the evaporative type liquid cooling unit using a water spray and fans to draw air over coils containing the liquid whose temperature is to be controlled, according to the manufacturer. This is accomplished by using either a steam coil or injector or an electric heating unit to heat the spray water. U. S. patent 2,321,933 has recently been granted on this equipment.

The result is control of liquid temperatures within prescribed limits, alternately cooling or heating as required, the maker states. The heating device is put into operation by thermostatic control at the desired point, preventing the liquid from becoming too cold for the process in which it is used, or from becoming viscous with retarded flow and loss of capacity, or from congealing or freezing. This also makes it possible for the heat exchanger to be installed outdoors, or to use outdoor air to increase its evaporative cooling capacity and avoid damage from handling air containing corrosive substances.

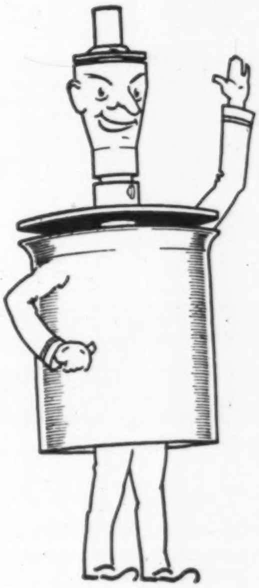
The heat exchanger with these features is used to control temperatures in industrial, chemical process, and electrical equipment by controlling jacket water temperatures, for quenching baths in the heat treating of metals, cutting oils, and lubricants in metal working, machining and wire drawing, controlling temperatures of chemical process liquids in many fields, and engine jacket water. It is also applied to air and gas compressors.—Niagara Blower Co., 6 E. 45th St., New York 17, N. Y.

New Rotary Pump with Steam-Air Engine Drive

No. 2473—A new rotary pumping unit of 50 gpm capacity, powered by an air-steam engine, was developed for handling gasoline and oils under conditions where electric power is not available, such as unloading wrecked tank cars or other carriers. The engine operates with either steam or compressed air and is connected to the pump through single reduction gears. Pump, gearing, engine and controls are mounted on a common bedplate.

The pump is iron fitted and has a capacity of 50 gpm at 76 psi pressure and a speed of 460 rpm, the maker states. The engine is 3 hp at 700 rpm.—Blackmer Pump Co., 1920A Century Ave., S.W., Grand Rapids 9, Mich.

CASTINGS



made by

John Zink Co.

TULSA, OKLAHOMA

Our foundry is under the capable supervision of a new foreman with over 40 years of foundry experience. Such supervision with our facilities to make light complicated castings enables us to furnish almost any type of castings involving numerous small cores.

We manufacture more than fifty types of gas and oil burners.

New York • Los Angeles • Detroit • San Francisco

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 127. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Air and Gas Compressors

No. 4495—22 p. booklet (L-600-B9-2), the second of a series, entitled Plain Talks on Air and Gas Compressors, with discussions of compression efficiency relative to heat of compression and as affected by valve slip and friction, effect of volumetric on horsepower, mechanical efficiency, and direct connected motor driven compressors. It is the intention of the booklet to recall to compressor users the basic principles of their successful operation and maintenance.—Worthington Pump & Machinery Corp., Harrison, N. J.

Arc Welding Accessories

No. 4496—36 p. bulletin (GEA-2704C) presenting a complete line of arc welding accessories, including protective clothing for both men and women operators, ventilated helmets and head protectors, observation shields, electrode holders, and various kinds of miscellaneous welding equipment such as slag chippers, electrode carriers, and fillet weld gages.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Boiler Feedwater Conditioning

No. 4497—32 p. publication (4008) on boiler feedwater conditioning and chemistry, dealing with the most common processes used and discussing characteristics of the hot process water softener, zeolite softener, removal of gases from feedwater, embrittlement and carryover. There is also a section on interpretation of water analyses, conversion factors, chemical reactions, formulas, molecular weights, etc.—Cochrane Corp., 3131 N. 17th St., Philadelphia 32, Pa.

Cooling Controls

No. 4498—12 p. bulletin (700) on cooling controls, covering self-operated temperature regulators and mixing valves to control cooling circuits on internal combustion engines, compressors, condensers, degreasers, stills, etc. There are many typical hookups, capacity tables, prices, etc.—Sarco Co., Inc., 475 Fifth Ave., New York 17, N. Y.

Electronics at Work

No. 4499—44 p. booklet (B-3264) illustrating and describing electronic applications in industry, in the war, in medicine, and in the home. Of particular interest to HPAC readers is the "Precipitron" for removing air borne dust particles. An educational motion picture of the same title —a 20 min sound film of 16 mm size—explaining the six basic functions of electronic tubes is available for loan, for showing at war plants and before engineering and technical societies. Also available is a 36 p. booklet (B-3260), The ABC of Electronics at Work, giving schematic drawings of tube construction and diagrams showing typical circuits, explaining how electronic tubes rectify, amplify, generate, control, transform light into current, and transform current into light.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Fabricated Piping

No. 4500—64 p. booklet, with numerous illustrations, covering various ways in which piping can be used, and showing applications for conveying gas, air, steam, oil and chemicals,

TELL THE BOYS WE'LL SHIP ALL YOUR DOLE VALVE NEEDS WHEN WE'RE THROUGH MAKING IT HOT FOR HITLER! MEANWHILE . . . THE BEST WE CAN!
DOLE
AIR AND VACUUM VALVES

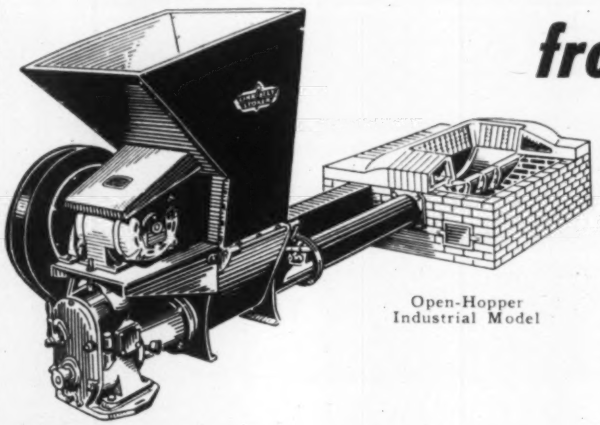
THE DOLE VALVE COMPANY, 1901-1941 CARROLL AVENUE, CHICAGO, ILLINOIS, U. S. A.

Commercial and Industrial

LINK-BELT

★ ★ ★ ★ AUTOMATIC COAL STOKERS ★ ★ ★ ★

are NOW Available for Conversion from Oil or Gas to COAL



Open-Hopper
Industrial Model

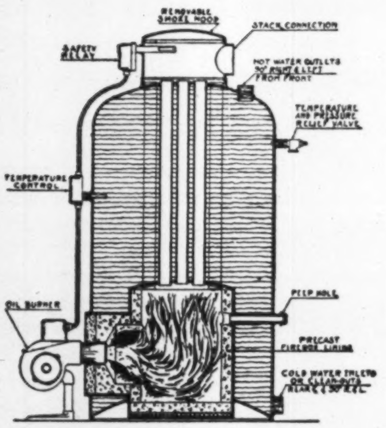
In a full range of sizes up to 300 B.H.P. for bituminous coal

Send for a copy of the new Link-Belt Conversion Book No. 1970. Address—

9137-C

LINK-BELT COMPANY

Mfg. Plant and Sales Hqtrs.: 2410 W. 18th St., Chicago 8, Ill.
Eastern Sales Hqtrs.: 420 Lexington Ave., New York 17, N. Y.


REMOVABLE SMOKE HOOD
STACK CONNECTION
SAFETY RELAY
HOT WATER OUTLETS 90° RIGHT & LEFT FROM FRONT
TEMPERATURE AND PRESSURE RELIEF VALVE
TEMPERATURE CONTROL
PEEP HOLE
OIL BURNER
PRECAST FIREBOX LINING
COLD WATER INLETS OR CLEAN-OUTS

This is the famous

AQULUX-225

... our most popular Heavy-Duty model. It is fully automatic. Has an 80% Efficiency Rating. Capacity—270 g.p.h. at 100' rise. Tank holds 230 gallons. Other Aqulux models have capacities up to 540 g.p.h.

WANTED by U.S. ARMY!

140,000,000 Gal. HOT WATER *every Day*

... for hot lather to wilt whiskers ...
hot showers to loosen aching muscles ...
hot dishwater for weary KP-s ... hot towels in the quiet hands of Army Nurses. Few items are more essential to the comfort, health and morale of fighting men.

What the exact daily consumption may be, only a magician could say. It can't be far from the figure named above which is based on 20 gallons per man for a 7,000,000 man army.

This much we *do* know; Aqulux Water Heaters built in our plant are supplying a *lot* of it. Army Posts all over America are using our big, wartime Aqulux models because of their high efficiency, their fuel saving, and because they are built with a minimum of essential materials (no insulation; no jackets; no galvanizing).

There is a double satisfaction for us in this assignment ... because it utilizes all the skill and experience we have gained in forty years of building fine oil-burners ... and because we know it contributes to the health and happiness of the men who are fighting our fight. Unspectacular, yes! But indispensable. Even though it may win no actual battles ... *hot water is "ammunition," too!*

If you are working on water-heating problems for the government or for an essential industry, perhaps we can help you. We'll gladly try.

S. T. Johnson Co., 940 Arlington Ave., Oakland, Calif.
and 401 No. Broad St., Philadelphia, Pa.

S. T. JOHNSON CO.

40 years of engineering and building fine Oil Burning Equipment

or for construction purposes. Present market prices "for every conceivable kind and size" of fabricated piping are listed, and there is a table of maximum allowable working pressures for seamless steel pipe.—Flori Pipe Co., 601 E. Red Bud Ave., St. Louis, Mo.

Galvanizing Compound

No. 4501—4 p. bulletin (52) on "Amco" galvanizing compound for repair and maintenance of any galvanized part in service, and repair of major galvanized equipment damaged during fabrication and assembly.—American Solder & Flux Co., 2152 E. Norris St., Philadelphia, Pa.

Heat Diffusers

No. 4502—4 p. specification sheet (46 PQR-16) on blower type heat diffusers, designed to heat and ventilate large areas, and available in floor mounted, horizontal suspended, vertical suspended, and inverted suspended models.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Hot Water Heating Boiler Protection

No. 4503—1 p. bulletin (L-50) explaining the "No. 247" boiler water feeder for use with hot water heating boilers where the boiler and radiation are on the same level, and showing the application of the "No. 29" safety relief valve. Control and valve are illustrated and diagrammed, a drawing is shown of the method of installation, and a capacity curve is presented.—McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill.

Hydraulic Control

No. 4504—8 p. bulletin (78-D) on "Exactor" hydraulic control for operation of industrial, marine, and aircraft equipment. This is a single tube remote control system with a capacity up to 400 in. lb and with motion through 55 deg without time lag or backlash. A number of applications are diagrammed and illustrated.—Sperry Products, Inc., 1505 Willow Ave., Hoboken, N. J.

Leather Belting Conservation

No. 4505—20 p. booklet (E) on leather belting conservation, with engineering data, including information on proper selection, installation, and maintenance of leather belts, methods for aligning shafting and pulleys, cleaning and dressing, horsepower ratings, and tables of belt speed and recommended pulley diameters, together with belting specifications.—Baldwin Belting and Leather Co., 85 Chambers St., New York, N. Y.

Low Temperature Brazing

No. 4506—4 p. issue of Low Temperature Brazing News (No. 23) giving a broad picture of applications of "Sil-Fos" and "Easy-Flo" in war production.—Handy & Harman, 82 Fulton St., New York 7, N. Y.

Marine Blowers

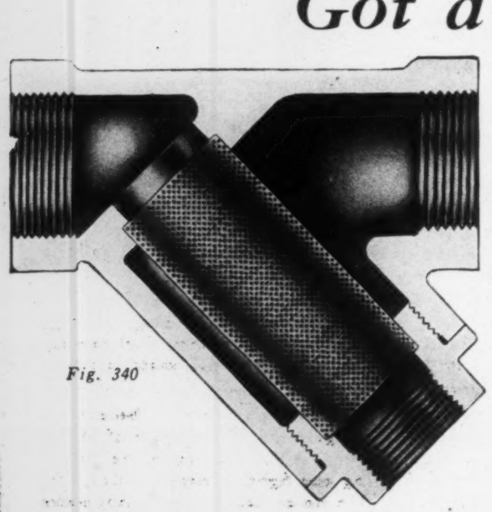
No. 4507—2 p. data sheet (SDA-93) giving specifications on direct connected marine ventilating blowers, equipped with waterproof, drip proof or splashproof a-c or d-c motors. —Peerless Electric Co., 3021 W. Market St., Warren, Ohio.

Marine Boilers

No. 4508—40 p. booklet (M-4) on marine boilers, including engineering data for naval architects, chief engineers, marine superintendents, and port engineers. Various boilers are described, and there are sections on physical properties of fuel oils, analyses of typical coals, and tables on properties of steam.—Babcock & Wilcox Co., 85 Liberty St., New York, N. Y.

Motors and Generators

No. 4509—Four 2 p. data sheets covering direct current motors of ¾ to 7½ hp; squirrel cage motors, ½ to 75 hp; shipboard pump motors; and shipboard auxiliary generators. The equipment is illustrated and briefly described.—Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.



Got a Control Valve Problem?

CALL ON K & M

Fig. 340

War has curtailed our civilian manufacturing—and multiplied the difficulties of your job. But don't let it get you down. If you have a problem involving pressure or fluid control—an installation, operating or maintenance problem —we can save you days of work and worry. Call on our new VALVE PROBLEM CLINIC. All the know-how of 65 years of specialization is yours for the asking . . . no charge, no obligation, no red tape. Whether or not you are using K & M equipment . . . we invite you to *call on K & M*.

K & M SIMPLES PRESSURE REDUCING VALVE, particularly applicable in reducing water main pressure to protect fixtures in residential or industrial service . . . or for other water, air, gas or cool oil service where space limitation is a factor and initial pressure is 150 lbs. or less. Sizes ½" to 2"—with traditional K & M efficient design and rugged construction.

KM KIELEY MUELLER ESTABLISHED 1879

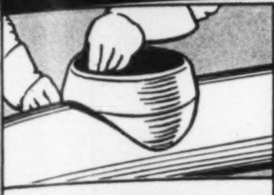
Kieley & Mueller

ENGINEERED PRESSURE & FLUID CONTROL SPECIALTIES

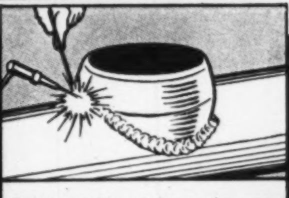
NORTH BERGEN, NEW JERSEY

Representatives in all Principal Cities

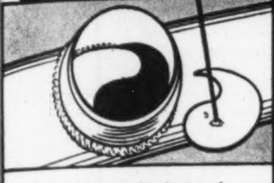
These 6 Steps Save Vital Man-Hours in Piping Installations



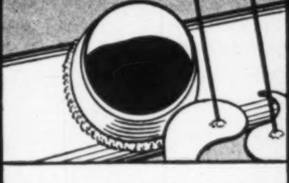
1—Install W-T's* anywhere on the main pipe without cutting, forming or fitting of the pipe. Simply select position of right-angle branch outlet and tack the fitting into place.



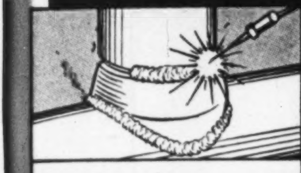
2—After tacking to insure the exact location of the W-T*, complete its installation by electric-arc or oxy-acetylene welding—following and filling the bevel at the base of the fitting.



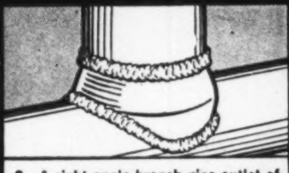
3—In most cases the button is removed in two sections with a torch after the WeldOlet or ThredOlet is installed—but where the outlet is smaller than 2", the hole should be cut in the main pipe first, using a drill or hole saw.



4—This method of making a right-angle, welded branch pipe outlet insures a junction of full pipe strength—permits inspection of inside of junction—allows removal of slag and excess weld metal.

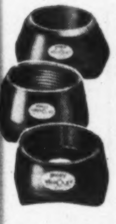


5—Branch pipe is attached by welding to outlet of fitting if WeldOlet or Socket-End WeldOlet has been used—or by screwing into threaded outlet of fitting if a ThredOlet has been used.



6—A right-angle branch pipe outlet of full pipe strength has been made without the use of templets, without threading or fitting the main pipe and because of the patented design of the fittings—flow conditions have been improved.

3 Types Meet Every Need



Made of drop forged steel—to provide maximum strength. Available for all standard pipe sizes up to 24". Branch pipe is attached to outlet of WeldOlet with plain, butt weld—to ThredOlet by screwing into threaded outlet of fitting—to Socket-End WeldOlet by weld around top of fitting after slipping branch pipe into outlet.

Other Advantages

Lightweight compared to screwed or welding tees—saves metal— eliminates need for extra hangers and braces.

Elimination of exterior obstructions makes neater, more workmanlike installation, permits easier covering.

Adaptable to any and all types of piping systems —pre-fabricated or "on-the-job" assemblies—new construction or maintenance.

Suitable for all commonly used pressures and temperatures.

Initial cost is less in most cases, than for other types of fittings to accomplish the same result. Installation savings run as high as 40%.

ARMY E NAVY

*WeldOlets ThredOlets

Forged Fittings Division

Bonney Forge & Tool Works, Allentown, Pa.

WELDOLETS·
THREDOLETS

Welded Outlets for Every Piping System

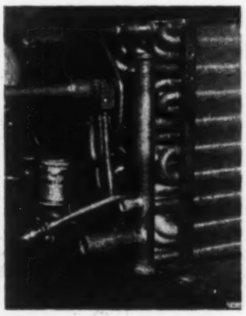
CHOW LINE . . .

somewhere in the South Pacific

Food is the most vital of man-controlled factors in war—as in peace. It must be kept fresh during long journeys by rail and sea and in camps. It must be cooked in camp and in the field.

This makes refrigerating equipment and cooking equipment mighty important items in the war effort. And it is in the construction of this equipment that the low-temperature silver brazing alloys, SIL-FOS and EASY-FLO, are making a major contribution—providing the **speed with reliability** so urgently needed in producing the permanently gas-tight and liquid-tight joints refrigeration demands, and the virtually indestructible joints that camp and field stoves and ranges must have—and doing these jobs at surprisingly low cost.

These are the same reasons why SIL-FOS and EASY-FLO were so extensively used in peacetime construction of commercial and industrial refrigerating, air conditioning and heating systems, cook stoves and ranges, and a wide variety of other products—the same reasons why SIL-FOS and EASY-FLO will be even more widely used in the metal joining operations of tomorrow.



A typical example of silver alloy brazed construction—a cooling unit fabricated completely with SIL-FOS joints.

ARMY E NAVY
1ST AWARD August 1942
2ND AWARD February 1943

BULLETIN 12-A GIVES YOU THE COMPLETE STORY

Explains fully why SIL-FOS and EASY-FLO are so fast, reliable and economical—tells you how to put them to work—gives a wealth of practical information on ferrous and non-ferrous metal joining with particular reference to joint designing and fast heating and production procedures. Copy mailed on request. Write for yours, today.

HANDY & HARMAN
82 Fulton St., New York 7, N. Y.
Agents in Principal Cities
In Canada: HANDY & HARMAN of Canada, Ltd., Toronto

Postwar Planning

No. 4510—27 p. booklet, Are You Overlooking Anything In Your Post War Planning?, enumerating seven immediate benefits and six future benefits which can be achieved in planning postwar operations.—Arthur J. Silberstein, Inc., 9 E. 40th St., New York, N. Y.

Protected Sheet Metal

No. 4511—4 p. bulletin on a sheet metal which is protected against weather, moisture, heat, cold, fumes, salt air and fire, which can be sheared, bent, Pittsburgh locked, malleted, die formed, riveted, soldered, and worked with regular shop tools. Applications include heating and ventilating ducts.—Cheney Metal Products Co., 625 Prospect St., Trenton, N. J.

Pump Maintenance

No. 4512—4 p. folder on preventing pump trouble by proper care and inspection, listing 10 ways to make rotary pumps last longer.—Blackmer Pump Co., 1920A Century Ave., S. W., Grand Rapids, Mich.

Recording Thermometers

No. 4513—40 p. bulletin (T800) on recording thermometers for temperatures between —125 and +1000 F, describing a line of recording thermometers and with considerable space given to basic theory of the several types and information on ranges, charts, bulbs, and tubing.—Bristol Co., P. O. Box 1790, Waterbury, Conn.

Relief Valves

No. 4514—4 p. reprint (26) presenting new sizing data on relief valves used for protecting low pressure equipment. Factors determining valve size are explained and data are given to show how size and permitted pressure drop affect capacity.—Cochrane Corp., 3131 N. 17th St., Philadelphia 32, Pa.

Separating Oil

No. 4515—4 p. reprint (24) on separating oil from steam, emphasizing the importance of selecting engine oil not alone for its lubricating properties but also for its subsequent removal facility.—Cochrane Corp., 3131 N. 17th St., Philadelphia 32, Pa.

Stoker Operating Guide

No. 4516—42 p. stoker operating guide (B3257) containing operating and maintenance suggestions and inspection charts to help keep single retort stokers on the job. There are suggestions regarding instruments, air requirements, fuel distribution, ash and clinker, boiler and furnace structure, coal segregation, automatic regulation, etc. Typical forms which may be used are illustrated.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

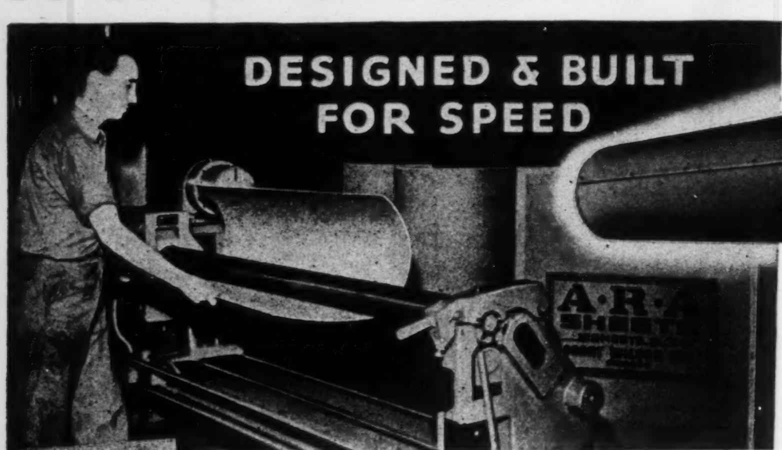
Utility Tape for Weatherstripping

No. 4517—4 p. leaflet describing "Mortite" utility tape, made of pliable plastic and put up in a convenient roll, which can be applied around doors, windows, transoms, and any crevice where cold air seeps in. It is pressed into place and does not require tacking, brads, or tools. It may also be used for gaskets.—J. W. Mortell Co., Kankakee, Ill.

Water Softeners

No. 4518—16 p. booklet (4021) on "Carbite" carbonaceous zeolite softeners, describing many applications including treatment of boiler feedwater supplies.—Cochrane Corp., 3131 N. 17th St., Philadelphia 32, Pa.

A·R·A SHEETS *are Workable!*



You can roll up A.R.A. Sheets satisfactorily and quickly on your own rollers into strong smooth round pipe. All you have to do is feed the sheets thru the same as you would a sheet of steel.

You can roll the back of fittings to make bends or you can roll round pipe. Standard metal (sheetlock No. 2 seams) can be used, or you can rivet, screw or staple longitudinal lap-joints in your shop or on the job. You can roll a piece of A.R.A. Sheet or a narrow strip of scrap metal to form either sleeve or collar for the butt joints. Try A.R.A. Sheets and be convinced.

NEW IMPROVED

Write today for the free 16-page illustrated booklet No. 89H, which describes the many outstanding features that are possible only in A.R.A. Sheets. Get genuine A.R.A. Sheets from your jobber.

Asbestos clad A.R.A. Sheets are tough yet flexible—rigid but not brittle—fire-proofed and water-proofed—will not dry out, crack, crumble, or chip, have a high insulating value (K. 45 B.T.U.) and good sound-deadening properties.
Here is the package of A.R.A. Sheets that make it the most convenient sheet to ship, stock or carry on the job. The Sheets are always clean and in good condition.

CARTON CONTENTS
20 Sheets 33" x 48" Per Carton
40 Sheets 16½" x 48" Per Carton

SHIPPING WEIGHT
Approximately
100 lbs. Per Carton

SHEET THICKNESS
Approximately
3/16" thick

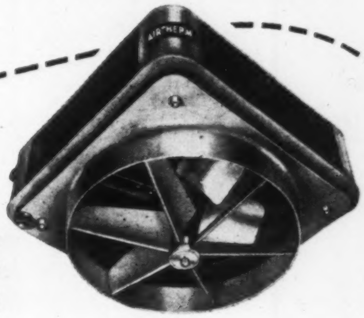
A·R·A SHEETS
GRANT WILSON, INC

4101 WEST
TAYLOR ST.
GRANT WILSON, INC.
CHICAGO
ILLINOIS

AIRTHERM

UNIT HEATERS

FOR VERTICAL DELIVERY



Insist on These Quality Features When You Buy Heaters in War Times!

Extra-heavy tube-wall thickness of .065".

Ingot iron tubes.

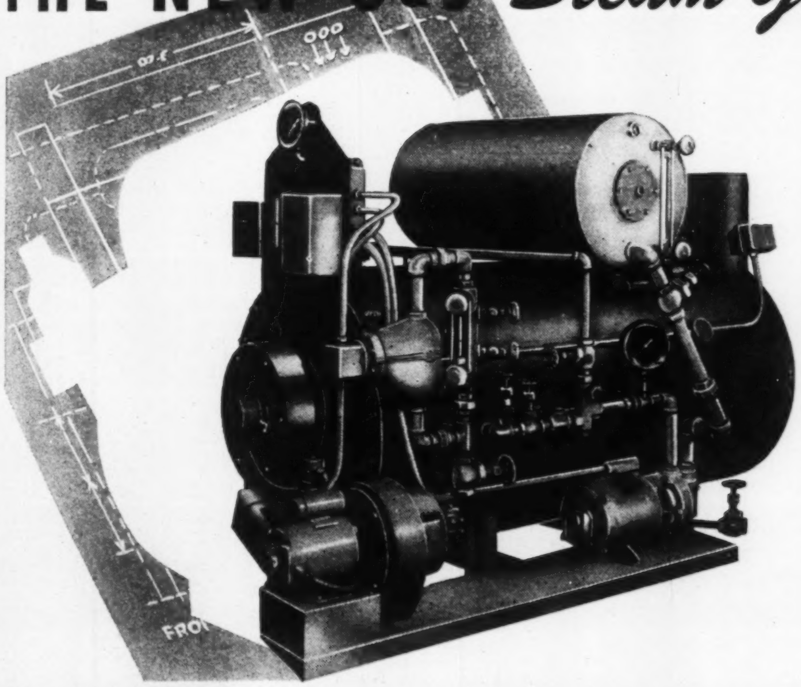
Lead-alloy coated condensers for greatest possible protection from corrosion.

Condensers guaranteed to withstand steam pressure up to 150 lbs. per sq. in.

FOR HORIZONTAL DELIVERY

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. • ST. LOUIS, MO.

THE NEW O&S *Steam Generating Unit*



Has More Than a Half Century of Boiler Engineering Behind it!

● Sturdy, compact, lightweight — this fully-automatic unit gives you exceptionally speedy steam production. It develops 100 lbs. pressure from 60° water in 18 minutes — or less! Back to this highly efficient unit is 58 years' experience in boiler engineering and manufacture.

Right now, the new unit is tagged "For Uncle Sam" . . . and some for plants with an AA2 or better. But you will want to investigate now — for the day when Victory makes O & S boilers again available for all purposes.

ORR & SEMBOWER INC. O&S *Builders of Better Boilers Since 1885*
READING • PENNSYLVANIA

MEN, INDUSTRIES and NATIONS

depend on

REFRIGERATION

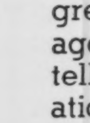
accurately controlled

Amazed disbelief would have greeted a man who, a few years ago, would have attempted to foretell today's wide use of Refrigeration! For who would have looked for Refrigeration in the Machine Shop, instrument factories, in aircraft plants — or on battle fronts in far-off islands and continents?

Tremendous progress in a short span of years, for an industry already close to American life and peoples. But it's a foretaste of great things to come.

In the vanguard of this progress, the skill and experience developed at AUTOMATIC PRODUCTS will provide important aid.

Our Research Division is working now on new plans. May we help with YOURS?



AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY — SECOND STREET
MILWAUKEE 10 WISCONSIN

AP DEPENDABLE Refrigerant Valves
. . . ARE STOCKED and SOLD
by JOBBERS EVERYWHERE

Useful Information

Modern Marine Engineer's Manual

Volume II of the Modern Marine Engineer's Manual—whose editor-in-chief is Alan Osbourne, senior engineer, U. S. Maritime Commission—is a big book—1200 pp., 444 illustrations—with a lot of information; it covers Diesel engines, refrigeration, heating, ventilation, insulation, deck machinery, electricity, instruments, propellers, tests and trials, and has many tables, diagrams and charts. It rounds out the first volume of this up-to-date and practical handbook, which contains material directly concerned with propulsion machinery on board turbine and reciprocating engine vessels, together with their auxiliaries.

The section on heating, comprising 109 pp., was prepared by John H. Clarke, of the USMC, author of the series of articles on ship heating published this year in Heating, Piping & Air Conditioning. It includes chapters on types of heating systems, design of steam heating systems, design of forced circulation water heating and cooling systems, electric heating, and operation of equipment. Heating equipment used aboard ship is carefully illustrated and described, and design data are fully and specifically presented.

The 56 p. ventilation section, by John W. Markert, of the USMC, is equally comprehensive, with chapters on ventilation requirements, general ventilation treatment, relation of ventilation and heating, insulation and its relation to ventilation and heating, ducts, equipment, and testing. The section concludes with a specific ventilation problem worked out in detail.

This handbook and its companion first volume are "musts" for all concerned with design or operation of merchant ships. The publisher is the Cornell Maritime Press, 241 W. 23rd St., New York, N. Y., and the price of Volume II is $4.00.

Piping Information Included in Plumbing Book

Admittedly written to encourage the application of engineering principles to the design of plumbing systems, the new book, Plumbing Practice and Design (Vol. I), by Svend Plum, commendably discourages "the growth of any class of handbook experts and catalog engineers." Although written for the plumbing designer, the book will be of interest to many piping engineers. Material is presented in summary form with liberal references to sources of detailed information.

Of particular interest is the chapter on corrosion. In a concise manner it discusses usual causes and the resistance of many of the more common materials. This chapter alone should be of assistance to most engineers.

FIRST CHOICE FOR THREADING
Sulflo No. 1—for hand tools
Sulflo No. 2—for power threaders
Machine-Kut—for screw machines
OTHER SULFLO PRODUCTS
Pipe Joint Compound
Soldering Paste
Blue Layout Liquid
At Your Supply House

SULPHUR THAT FLOWS
SULFLO
THE MODERN CUTTING OIL For THREADING PIPE

Sulflo, Inc.
1143 EAST JERSEY ST. ELIZABETH, NEW JERSEY

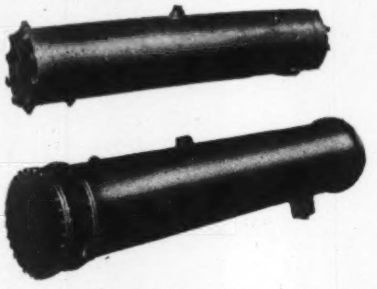
25 YEARS' SERVICE TO THE INDUSTRY

ACME PRODUCTS

..... A perfect combination for industrial process installations.....

●

1—Freon Shell and Tube Condensers



CAPACITIES
2½ TONS to
450 TONS

Copper or
Steel Tubes

CLEANABLE

Many Water Pass
Combinations

Larger Sizes Cleanable without Breaking Water Connections. *Ask for Catalog 23.*

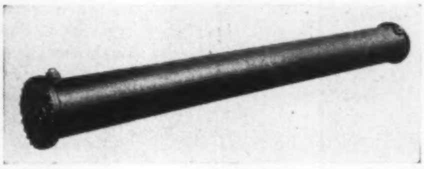
●

2—Dry-Ex Water Chillers ....

Controlled water velocity

Low refrigerant charge

Non-freeze

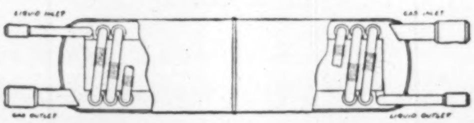


Capacity 5 to 100 tons. Especially adapted to water chilling for all industrial processes. Catalog 5.

●

3—Heat Exchangers ....

SUCTION LINE



30 to 180 tons capacity: Shell and tube construction . . . 1 to 50 tons capacity: Shell and fin coil construction. Catalog 12.

●

ACME INDUSTRIES
Jackson • Michigan

Insulation for COLD
from a Man-Made Volcano!

ACCORDING TO LEGEND, the first mineral wool was produced during an eruption of the volcano Kilauea in Hawaii. Geological survey revealed this substance to be lava, blown into soft threads by the gigantic forces of the volcano.

Today, at Johns-Manville factories, in man-made volcanoes, molten silica minerals are blown by means of steam into silky fibers. These mineral fibers are formed into Rock Cork, which is exceptionally efficient for low-temperature insulation. Rock Cork is immune to termites, vermin and mold. It can't rot, does not absorb odors.

Mineral wool is one of four basic materials from which all Johns-Manville products stem: Asbestos, asphalt, diatomaceous earth and mineral wool. Today, Johns-Manville has but one aim: To make these products in the quantities needed to help win the war. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM PRODUCTS

Johns-Manville
ROCK CORK

CORK FOR ALL PURPOSES

NOW AVAILABLE

Corkboard and moulded cork pipe covering are now available without priority for air conditioning and other applications of low temperature. To obtain maximum power savings, use Mundet Cork Insulation. We shall be glad to help in the preparation of specifications. Mundet Cork Corporation, Insulation Division, 65 S. 11th St., Brooklyn, N. Y.

MUNDET
CORK INSULATION

CONSERVES LOW TEMPERATURE

PERFORMANCE PLUS
with
Economy
SCV
Pumps

Economy's new vertical type pump for clear liquid services. Highly recommended for hot and cold water circulation, air conditioning systems, brine circulation, sprinkler equipment, boiler feeding, pressure boosting, etc.

- Vertical in design—saves floor space.
- Motor high and dry—away from splash and dirt.
- Complete rotor easily removed without disturbing piping connections.
- Impeller keyed to extra heavy shaft rotates between both an outboard and inboard bearing—smooth and noiseless operation.
- Built in sizes with discharges 1" to 3", for capacities from 10 to 500 GPM, with heads up to 225 feet.

Write for fully illustrated and complete descriptive Catalog No. D2-1042.

ECONOMY PUMPS, INC.
1011 WELLER AVENUE — HAMILTON, OHIO

The chapter on materials is unfortunately not as broad in scope as might be desired, but does contain many comments as to the suitability of the listed materials. The discussion of pipe and fittings agreeably combines standard specifications with definitions of piping terminology. Inclusion of much tabular data makes this section of the book a ready and useful reference.

Valves and controls are discussed from the viewpoint of the plumbing designer and as such are limited in scope. Narrow definitions, lack of scope, and inclusion of dimensional data peculiar to only one manufacturer unfortunately handicap the usefulness of this otherwise worthwhile discussion.

The chapters on pumps and air compressors are based on the respective institute standards with interwoven comments by the author, a presentation that should be helpful to the designer and operator.

Of particular interest to the plumbing designer, the book contains much helpful reference material to mechanical engineers as a whole.

There are 308 + vii pp., 5⅞x9 in. The publisher is John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y., and the price is $4.50.—A. C. K.

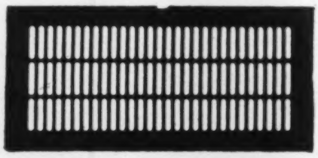
Letter Symbols for Heat and Thermodynamics Including Heat Flow

The American Standards Association has issued American Standard ASA Z10.4-1943, Letter Symbols for Heat and Thermodynamics Including Heat Flow. Prepared by the sectional committee on letter symbols and abbreviations for science and engineering, and approved June, 1943, it consists of an extensive revision of the tentative standard approved and published in February, 1931.

General and special principles of letter symbol standardization are briefly reviewed, and the symbols themselves are presented and defined.

Copies of this 20 p., 8 x 10½ in. publication are available from the ASA, 29 W. 39th St., New York 18, N. Y., for 55c.

War Products Come First!

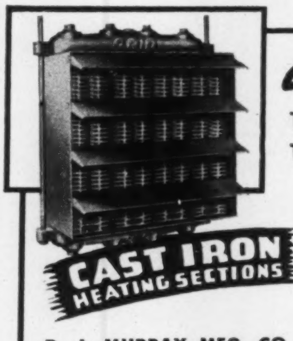


Auer is now engaged pri cipally on vital aircraft par and other war-time products. W are still able to furnish most sty of registers from inventory stock for all purposes permitted by Fed eral regulations. We are also we equipped for sub-contracts on meta stamping and fabricating, in gauge 10 to 24, and invite your inquiry o priority war goods.

Auer Register Book sent on reques

THE AUER REGISTER COMPANY, Cleveland, O

AUER REGISTERS
& GRILLES · For Air Conditioning *and* Gravity



D. J. MURRAY MFG. CO.
WAUSAU, WISCONSIN

a UNIT HEATER
THAT WILL LAST AS LONG AS THE BUILDING ITSELF . . .

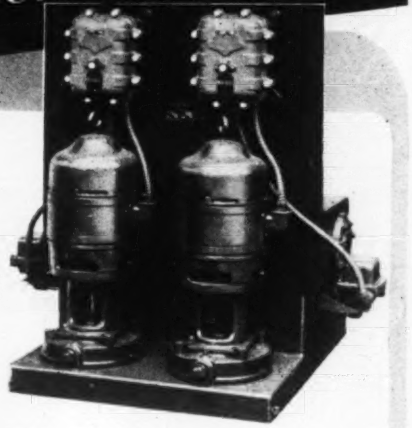
DESIGNED and tested to operate with either steam or hot water—up to 250 lbs. steam pressure. Lower outlet temperatures . . . greater air volume . . . more air changes per hour . . . no electrolysis to cause corrosion. Each "fin" heating section cast in one piece of high test cast iron . . . no heating failures . . . no leaks . . . no breakdowns . . . no maintenance expense. Made in 9 sizes—Patent applied for. *Territory open for high grade distributors.*

GRID UNIT HEATER

quick delivery

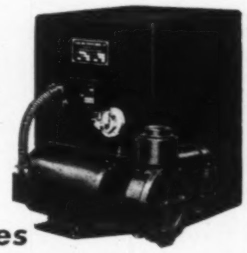
EXPLOSION PROOF

condensate pumps



Immediate delivery

from stock on Sterling EXPLOSION-PROOF CONDENSATE PUMPS, in varying sizes and capacities.



Standard types

of condensate pumps for high and low pressures.

All sizes and types

Many sizes of Standard Condensate Pumps are also available for shipment on short notice.

Take advantage of this NOW for important replacements. Can ship on A-10 priority. For further information and quotations, write

sales department

STERLING, Inc.

4015 N. Oakland Ave. Milwaukee 11, Wis.

THE ENGINEERING STAFF
THAT DEVELOPED

PETRO

REG. U. S. PAT. OFF.

OIL BURNING SYSTEMS

FOR PEACE

has developed, on confidential assignment, a new Petro unit for war purposes. It may be important in *your* business after Victory.

An entirely different apparatus has been Petro designed at the request of another arm of the service and it, too, may mean something to your "regular business", post-war.

Meanwhile regular, standard Petro Systems are standing up to 24-hour, overload jobs in a large number of America's well-known machine tool factories, in "Government plants", and in conventional applications at fighting bases, on ships, etc.

—and the precision-production skills of our factory are being whetted to a keener edge by the volume production of fighting tools such as firing bolts, shell dies, signal apparatus, and so on.

These things will help to give you better Petro Oil Burning Systems when normal construction is resumed.

Oil Is Ammunition
Use It Wisely

PETROLEUM HEAT AND POWER COMPANY

Makers of Good Oil Burning Equipment
Since 1903

STAMFORD CONNECTICUT

Mortite UTILITY TAPE

HUNDREDS OF USES

★

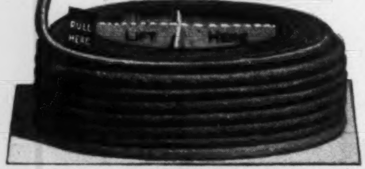
INSULATES • WEATHERSTRIPS
PLUGS UP CRACKS • MAKES PACKING
OR GASKETS • CAULKS CASEMENTS
GLAZES WINDOWS

This new pliable plastic does not crack, chip, dry out or shrink. Easy-to-handle, unrolls like ribbon and is ready for use, inside or outside. Can be painted.

SIMPLE TO APPLY

Mortite adheres to any clean, dry surface. No tacking or tools needed, just press into place and it stays put.

About 80 ft. to a box. Order through your supply house or $1.25 postpaid. ($1.40 west of Rockies.)



Circular Free

J. W. MORTELL CO.
512 BURCH ST.
KANKAKEE, ILLINOIS

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

NoDrip A SURE CURE

• This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition surfaces. Permanently protects metal against rust and côrrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance. A gallon covers about 30 feet of ½" pipe. Dries in 24 hours. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House.

FREE *NoDrip Circular about Condensation Drip and its Prevention.*

APPLY WITH BRUSH, TROWEL OR SPRAY

J. W. MORTELL CO.
Technical Coatings Since 1895
512 BURCH ST. KANKAKEE, ILL.

WPB Orders Issued Last Month

Among War Production Board orders of particular interest to heating, piping, or air conditioning men issued last month are the following:

Limitation order L-187, as amended July 1, pertains to low pressure cast iron boilers and establishes certain restrictions on manufacture, fabrication, and assembly. Manufacture of parts to convert from oil or gas burning to solid fuel, and repair parts for military or hospital installations, are exempted from the order's requirements.

Limitation order L-172, as amended July 9, pertains to heat exchangers. It broadens the coverage to include additional types and sizes but makes a distinction between the most critical types and others.

Schedule I of limitation order L-126, as amended July 10, gives required specifications for self-contained drinking water coolers.

Preference rating order P-141, as amended July 5, is devoted to maintenance, repair, and operating supplies for public sanitary sewerage facilities.

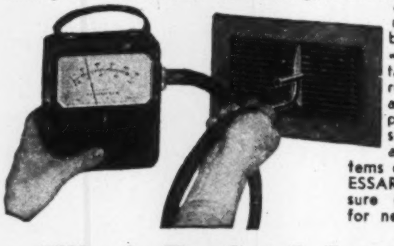
Interpretation I to limitation order L-272, simplifying control valves, regulators, and other instruments, prohibits manufacture of nonstandard items except where required by specifications of a claimant.

Conservation order M-28, as amended July 10, sets up eight classifications of users of chlorinated hydrocarbon refrigerants, provides for certification of orders by users and suppliers and for deliveries and records, and lists prohibited uses. Prohibited uses comprise comfort cooling systems, skating rink systems, and refrigeration systems solely for storing or dispensing carbonated or malt beverages.

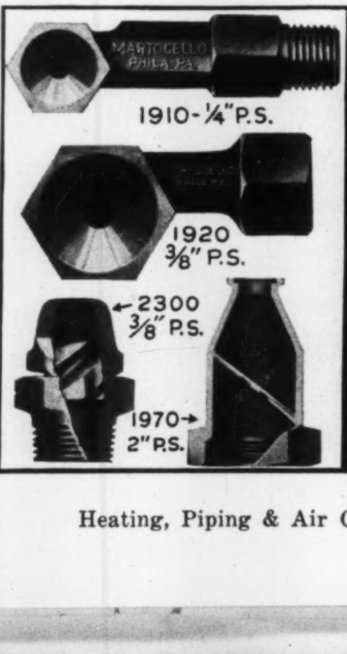
"ALNOR" VELOMETER

DIRECT READING AIR VELOCITY METER

"Alnor" Velometer fills the need for a simple, accurate means of determining air velocity in air conditioning, forced air exhaust ducts, etc. Peak efficiency operation is now more important than ever before . . . and Velometer with its many simple attachments assures correct readings, under the most adverse conditions, in feet per minute, right on the scale! These readings enable you to gauge the systems efficiency and MAKE NECESSARY ADJUSTMENTS to assure greatest efficiency. Write for new catalog now!



Illinois Testing Laboratories, Inc.
412 N. La Salle St., Chicago, Ill.



MARTOCELLO
SPRAY NOZZLES

Manufactured with precision and of a design which has been thoroughly tested for results and durability, they are guaranteed to give you satisfaction.

Successful efficient results depend largely upon selecting the proper number and type of Nozzle suitable for your installation. Consult with us.

Jos. A. Martocello & Co.
229-231 North 13th St., Phila., Pa.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1943, Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.

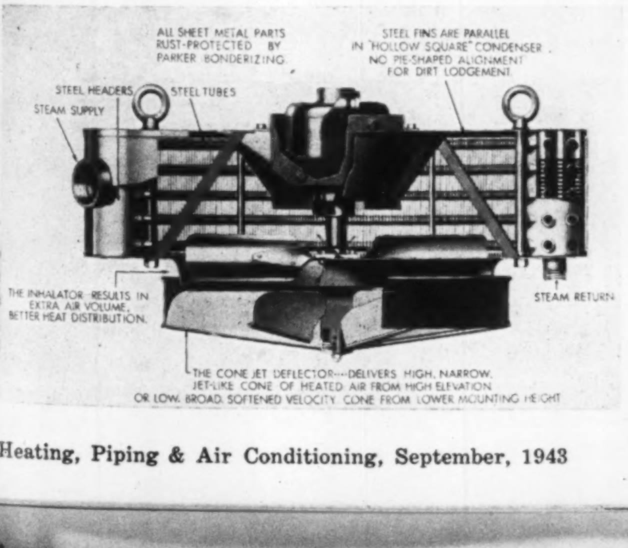
Nonmetallic Duct Assembly Method

No. 2474**—A method of fabricating air ducts made from asbestos cement or other nonmetallic boards is to set the boards in "Sheetlock" prefabricated steel corners, and to hold the boards to the metal by means of steel strapping. The steel strapping is tensioned and the duct sections are often joined together with 3 in. strips of asbestos material cemented over the joints. According to the strapping manufacturer, "a duct can be assembled in five minutes at a saving of 40 per cent."

The photo shows tension being applied to the steel strapping by strap applying equipment which forces the boards into the metal corners to form tight joints. Among the recent applications of this method was a barracks installation at an army air base.—Acme Steel Co., 2840 Archer Ave., Chicago 8, Ill.

Vertical Delivery Unit Heaters

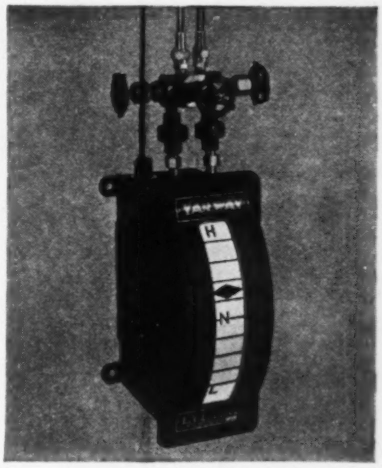
No. 2475—Units in a new series of vertical delivery unit heaters with steel condensers range in capacity from 149,000 to 600,000 Btu per hr. Designed for wartime application, the steel condensers are protected against corrosion by a special coating of lead alloy. Fins are permanently bonded to tubes with metal.


ALL SHEET METAL PARTS RUST-PROTECTED BY PARKER BONDERIZING
STEEL FINS ARE PARALLEL IN "HOLLOW SQUARE" CONDENSER NO PIE-SHAPED ALIGNMENT FOR DIRT LODGEMENT
STEEL HEADERS
STEEL TUBES
STEAM SUPPLY
THE INHALATOR RESULTS IN EXTRA AIR VOLUME, BETTER HEAT DISTRIBUTION.
STEAM RETURN
THE CONE JET DEFLECTOR—DELIVERS HIGH, NARROW, JET-LIKE CONE OF HEATED AIR FROM HIGH ELEVATION OR LOW, BROAD, SOFTENED VELOCITY CONE FROM LOWER MOUNTING HEIGHT

The tubes and headers are brazed with silver solder to form an integral unit of steam carrying passages guaranteed by the manufacturer for working steam pressures up to 150 psi.

These units are available with standard "Cone-Jet" deflectors, or with "Truncone" deflectors or "Anemostats." The larger models may be mounted as high as 50 to 60 ft above the floor, it is stated.—Modine Mfg. Co., 1772 Racine St., Racine, Wis.

Remote Water Level Indicator



No. 2476—A new instrument which may be wall or panel mounted shows the level of water in a boiler drum. It is operated by the difference in pressure in the connecting tubes which is merely the difference in head between the fixed water level in the upper pressure pot and the varying water level in the boiler drum.

The pressure differential acts on a "Neoprene" diaphragm, a pin transmits the net diaphragm force to a spring metal deflection plate, which moves a permanent magnet along a bronze alloy tubular well which contains a spiral armature of magnetic material. The rotation of the armature and the

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago 2, Ill. [9-43]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Trade Literature.

(Circle each number in which you are interested):

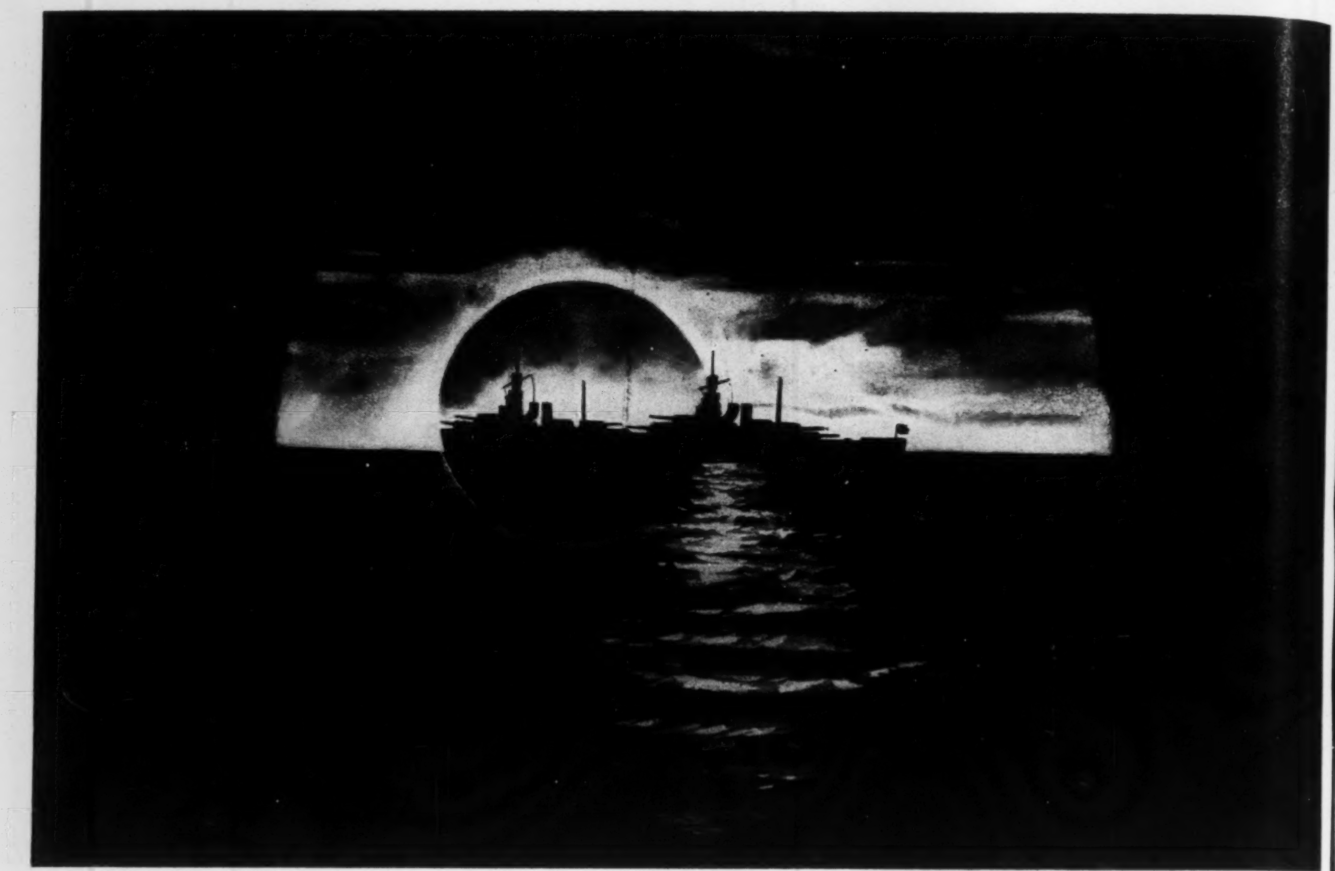
2474 2475 2476 2477 2478 2479 2480 2481 2482 2483
2484 2485 2486 2487 2488 2489 2490 2491
4519 4520 4521 4522 4523 4524 4525 4526 4527 4528
4529 4530 4531 4532 4533 4534 4535 4536 4537 4538
4539

Name.............................. Title............

Company ....

Address ....

City........................... State...........



How a drop of water may help the Axis

THE amount of moisture in the air in an optical shop may determine whether an Axis ship is sunk or whether it eludes an American warship. One single drop may prevent the destruction of an enemy vessel.

The abrasive used to grind the delicate lenses of naval range finders soaks up moisture like a sponge. If the air in the optical shop is too humid, the abrasive becomes a saboteur. It unites with moisture to scratch, distort, and ruin the lens. A hairline off balance may mean a miss of a quarter mile.

Inspection weeds out most of the faulty pieces, but dry air is the best inspector. It prevents rejects and steps up all-important production.

Naval requirements set 30% relative humidity as a moisture ceiling. Skilled Trane Air Engineers have translated these requirements into weather battle plans, from which have been produced Trane Air Conditioning Equipment to exactly meet the requirements of the job.

By training on our enemies the guns of our ally, the weather, the drop of water that might prevent a perfect aim is safely disposed of in the drain pan of a Trane Climate Changer.

TRANE

AIR

THE TRANE COMPANY LA CROSSE, WISCONSIN
TRANE COMPANY OF CANADA, LTD., TORONTO
AIR CONDITIONING · · HEAT TRANSFER · · AIR HANDLING EQUIPMENT

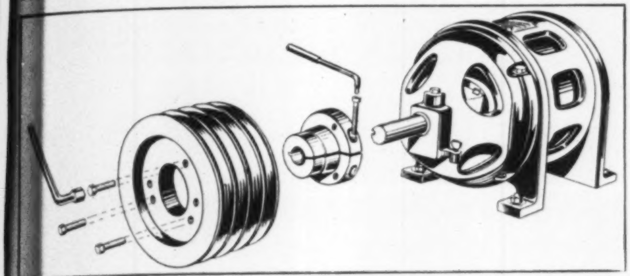
correspondingly magnified motion of the pointer is in direct proportion to the movement of the diaphragm.

The magnetic principle permits complete separation of pressure parts from nonpressure parts without stuffing boxes. There are two models designed to serve on boiler pressures up to 1500 psi.—Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.

Quick Detachable Sheaves

No. 2477*—The outstanding feature of the new "QD" quick detachable sheave for multiple v belt drives is the ease with which it may be attached to or removed from the shaft, according to the manufacturer. A socket wrench is the only tool needed.

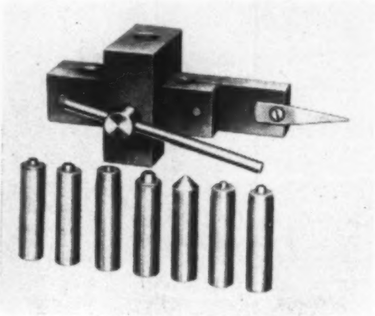
The first step is to slip the tapered split hub onto the shaft in line with the keyway. Then the headless cap screw is tightened down with an inserted key, clamping the hub firmly on the shaft, and producing "a virtual press fit even on undersized or oversized shafts." The next step is to attach the sheave on the tapered hub. Actual tightening of the sheave on the hub is accomplished by inserting the pull-up bolts and tightening them evenly with a socket wrench. These bolts protrude through the sheave and engage with threaded holes in the hub.



Such sheaves are particularly useful where factory runin tests prior to shipment are advisable, says the manufacturer. On completion of the test the hub can be left on the shaft, thus giving the equipment the extra advantage of a pre-aligned drive.—Pyott Foundry & Machine Co., 328 N. Sangamon St., Chicago, Ill.

Flaring Tool for Copper Coated Tubing

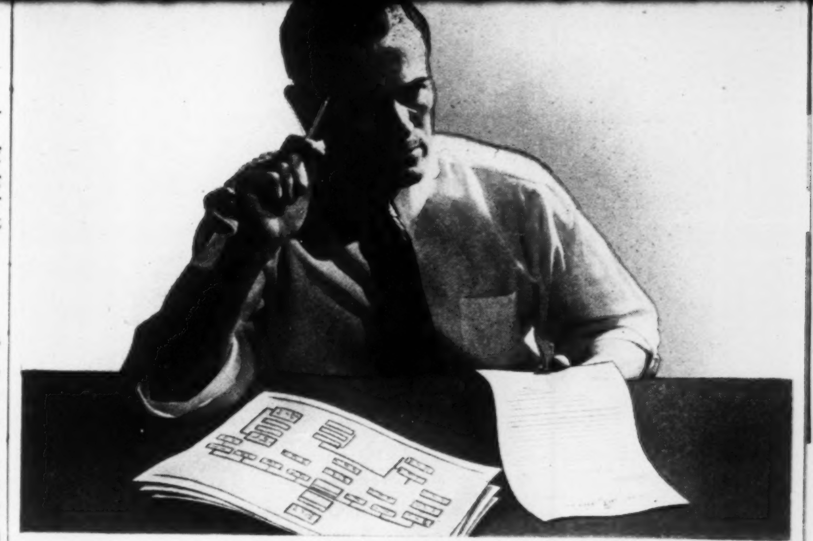
No. 2478—"Bundyflex" soft steel copper coated tubing, designed to take the place of copper and aluminum tubing, was introduced several months ago. According to the manufacturer, with the recent introduction of the new "Flaremaster" flaring tool, it is possible to employ this soft steel tubing on even more applications. The tool is designed to produce a double lap flare that will not crack or collapse on any ferrous or nonferrous tubing in sizes from ⅛ to ⅝ in. OD.



Applications include gasoline lines, vacuum lines, oil lines, refrigerant lines, lubrication lines, connecting tubes on gas appliances and oil burners, etc.—Everhot Products Co., 2059 W. Carroll Ave., Chicago, Ill.

Nylon Plastic Has High Softening Point

No. 2479—Nylon is expected to enter a vast, new field as a plastic after the war. Nylon plastic, now used for several secret military purposes, is characterized by a high softening point and great toughness.



Are You Working on Post-War Plans?

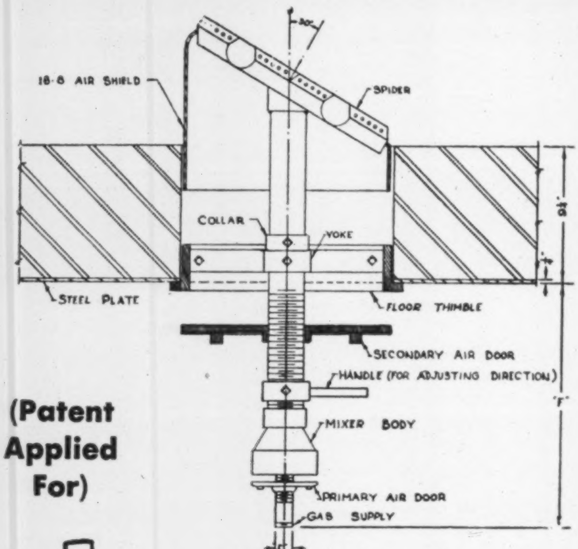
When the war is over will your organization—your product—your service—readily adapt itself to post-war conditions? Have wartime developments revealed the extent to which new designs and methods must be considered?

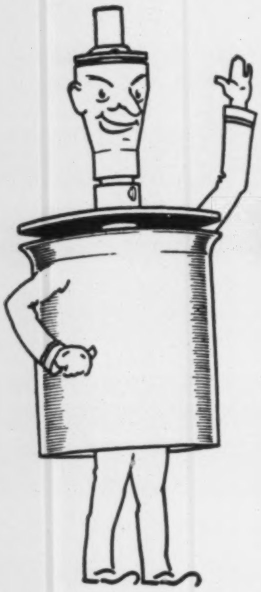
We at White-Rodgers cannot answer these questions for you. But, if the control of temperature and pressure is essential to the successful application of your product or service, we will be glad to tell you about the White-Rodgers Hydraulic-Action principle of temperature control and the advantages it offers.

To assist you in setting up your post-war plans we have prepared a "Post-War Planning Checklist." We will be glad to send you a copy upon request.

HYDRAULIC ACTION CONTROL

WHITE-RODGERS ELECTRIC CO.
1205j CASS AVE. ST. LOUIS, MISSOURI





(Patent Applied For)

John Zink DIRECTIONAL Heat BURNER

•

The direction of the fire is *controlled* by changing the direction of the *drilled burner spider*. With this burner the heat may be directed to any part of the furnace for the best performance of that particular furnace. The John Zink DIRECTIONAL HEAT BURNER performs equally well on either Forced or Natural Draft.

The John Zink FOUNDRY has the experienced supervision and facilities to make light castings involving numerous small cores.

Write for Details Now!

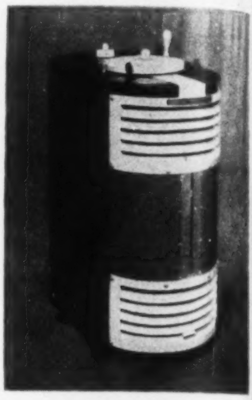
John Zink Co.
TULSA, OKLAHOMA

New York • Los Angeles • Detroit • San Francisco

The new material is a thermoplastic, which means that under heat and pressure it can be reshaped and reformed any number of times. The softening point is 450 F. Nylon plastic's toughness is particularly useful where thin sections with great strength are required.

It has other outstanding advantages, says the manufacturer. It is one of the lightest plastics in weight. It burns slowly; undergoes little or no deterioration with age; is only slightly affected by sunlight; resists oil, grease, solvents, alkalis and weak acids; is easily machined; has good electrical properties; and can be molded with existing equipment with minor modifications.—E. I. du Pont de Nemours and Co., Inc., Wilmington 98, Dela.

Outdoor Alternating Current Welder



No. 2480—A new 500 amp outdoor alternating current welder has a welding current range from 100 to 625 amp at 40 volts and has been especially designed for use in shipyards and other locations where exposure to the weather is encountered.

A feature of the machine is an "idlematic" control which automatically reduces the output voltage to less than 35 volts whenever the arc is not in operation, but provides full power for welding when the arc is struck, says the manufacturer. The welder is protected against rain, snow and sleet by drip proof construction of all openings in the top of the case and by a sealed window over the current indicator. Internal parts have a special finish for protection against corrosion from moist air.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Wall Mounted Power Pump

No. 2481—A mounting arrangement designed for use with rotary pumps on certain types of larger naval craft permits attaching the entire unit to a bulkhead or other vertical surface. The base is fabricated of steel plate and angles so welded that they provide an adequate mounting surface for the pump and power unit.

The pump furnished with the new mounting is a standard unit of 25 gpm capacity, 15 psi pressure, 450 rpm. and powered by a 1½ hp, 1800 rpm gearhead motor. Designed primarily for marine use, it also has many industrial applications.—Blackmer Pump Co., 1920A Century Ave. S.W., Grand Rapids, Mich.

Valve Repair Division

No. 2482—It was announced recently that the Farris Engineering Co., Ridgefield, N. J., has established a new division to handle valve repairs. According to the announcement, the division is manned by skilled mechanics engaged in the actual manufacturing of valves and is equipped to recondition and reconstruct all types of reducing, relief, and standard or special valves and control apparatus.

Facilities of the department also include complete testing apparatus.

Pipe Gage

No. 2483—A patented pipe gage that measures all sizes of pipe from ⅛ to 12 in. is of vestpocket size, light in weight, and is constructed of steel. It measures the size by determining the outside arc of the pipe at three points of contact. The two fixed contact points of the gage are placed against the outer contour of the pipe and then the movable part of the gage is adjusted until it makes the

Make Fuel Produce Maximum Heat!

KEEP BOILERS 100% EFFICIENT

THESE "X" PRODUCTS ARE AVAILABLE *today* TO HELP YOU DO THIS PATRIOTIC JOB

X
LIQUID
REPAIRS LEAKS
IN
STEAM & HOT WATER SYSTEMS
HIGH & LOW PRESSURE BOILERS
X
X
"X"
FLUSH
REMOVES GREASE, OIL SCALE from HEATING SYSTEMS
STOPS FOAMING
"X"
RUSTOFF
WATER INHIBITOR
KEEPS SYSTEM CLEAN
X
PIPECUT OIL
X
PIPEJOIN
SEALS

OTHER "X" SPECIALTIES

"X"
PIPECUT OIL
Forms film on pipe threads. Keeps dies cool.

"X"
PIPEJOIN
Light grey in color. Seals water, gas, steam joints and gaskets.

"X" LABORATORIES, INC., 25 WEST 45th ST., NEW YORK

third contact. A marker on the gage shows the correct pipe size.

The gage also shows the exact drill size for tapping. —Three-Point Gage Co., 3821 Broadway, Chicago, Ill.

Pressure Switch for Liquids, Air, or Gases

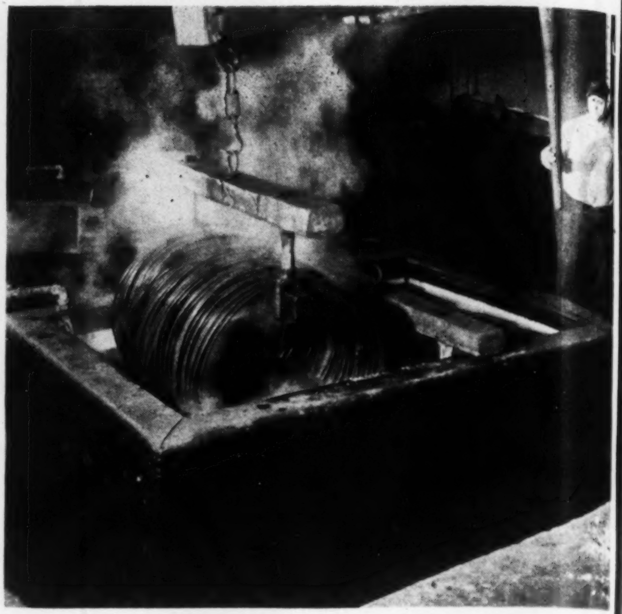
No. 2484*—A compact pressure switch for controlling pressures of liquids, air, or gases is suitable for operation up to approximately 100 psi with a high degree of accuracy, the manufacturer states. The switch operation depends upon the effect of pressure upon a spring compensated bellows that operates a snap action beryllium copper switch.

This unit may be used for either direct or alternating current. — Vapor Car Heating Co., Inc., 80 E. Jackson Blvd., Chicago, Ill.

Glass Tanks Used in Industry

No. 2485—An important advance in the glass industry has been the development of glass tanks or vats for industrial use, according to R. B. Tucker, of the Pittsburgh Plate Glass Co. Many industries are turning to glass for their tanks, he says, and the installation of new tanks and the relining of existing units with glass is increasing rapidly. The tanks are made resistant to quick temperature changes by a special tempering process.

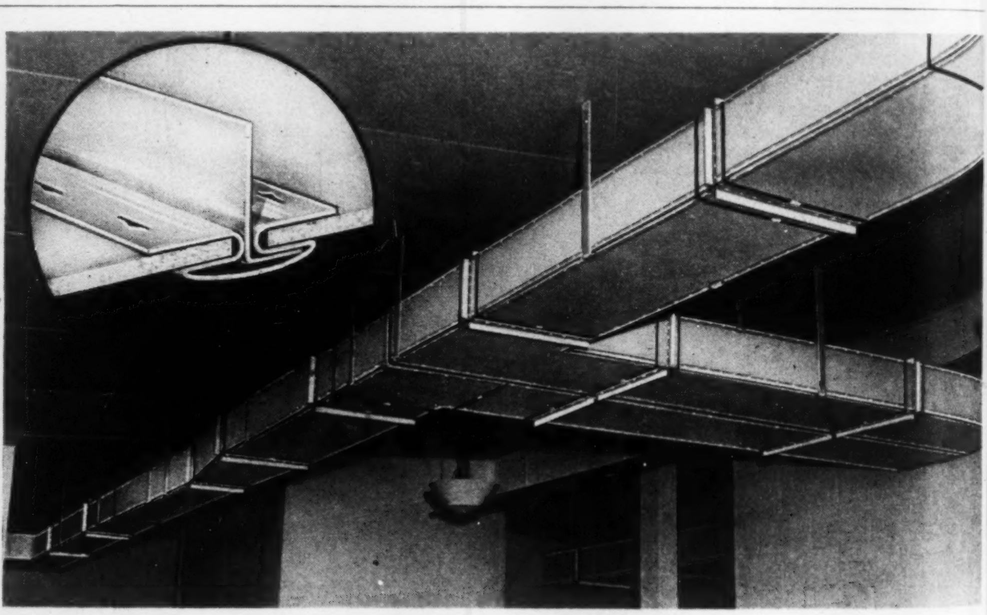
These tanks are built of opaque Carrara structural glass or of clear plate glass where transparency is desirable. They are manufactured complete at the factory, but if new linings are required for existing tanks, trained crews of installers are sent to do the work.



The photo shows a tank used for pickling steel wire, the tank being lined with Carrara structural glass. The chemical used is sulphuric acid.—Pittsburgh Plate Glass Co., 2000 Grant Bldg., Pittsburgh, Pa.

Pneumatic Atomizing Nozzle for Humidification

No. 2486—In an improved type of pneumatic atomizing nozzle for humidification systems, the water and compressed



Ducts using SHEETLOCK connecting asbestos cement board. SHEETLOCK strips are used on corners and to connect duct sections. Reinforcing T bars, suggested by SHEETLOCK CO. are used for added support. Acme STEELSTRAP used around ducts make them extremely rigid.

●

Write for our new folder on time saving "Fabricating Methods" showing easy ways developed by tradesmen in fabricating non-metallic sheets.

●

Obtain Sheetlock from your jobber—No priority. Sheetlock Strips come in different sizes and shapes for specific purposes and uses.

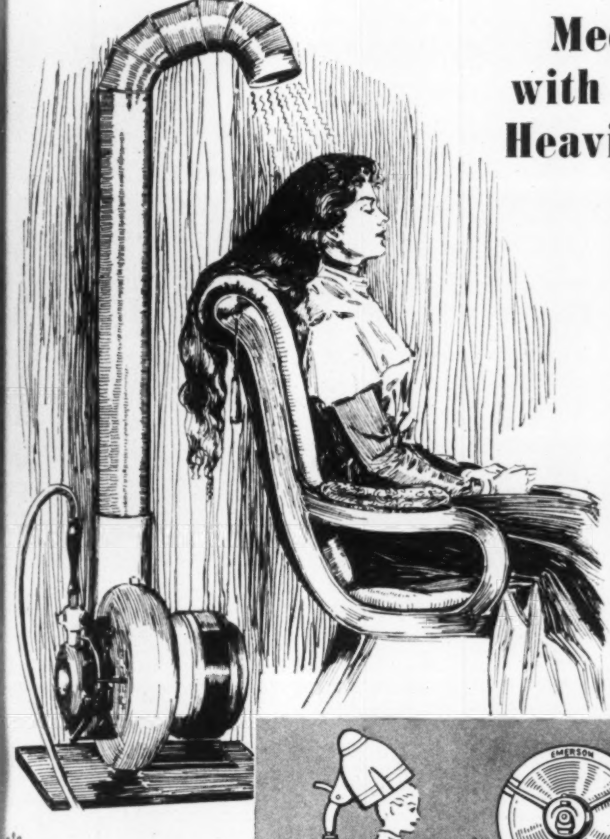
The BIG JOBS USE SHEETLOCK!

When labor is at a premium and the time element is vital, Sheetlock, the self-fastening strip is doing a real job of fabricating.

Sheetlock is designed for DUCT fabrication, using any type sheet board on the market today.

Sheetlock is easy to work—simply push the board into the Sheetlock channel, and specially designed notches hold it firmly and securely. No nails, screws, or bolts required. Sheetlock is also used in manufacturing cabinets, shower stalls, lockers, etc.

SHEETLOCK COMPANY • 4521 N. CLARK ST., CHICAGO, ILL.



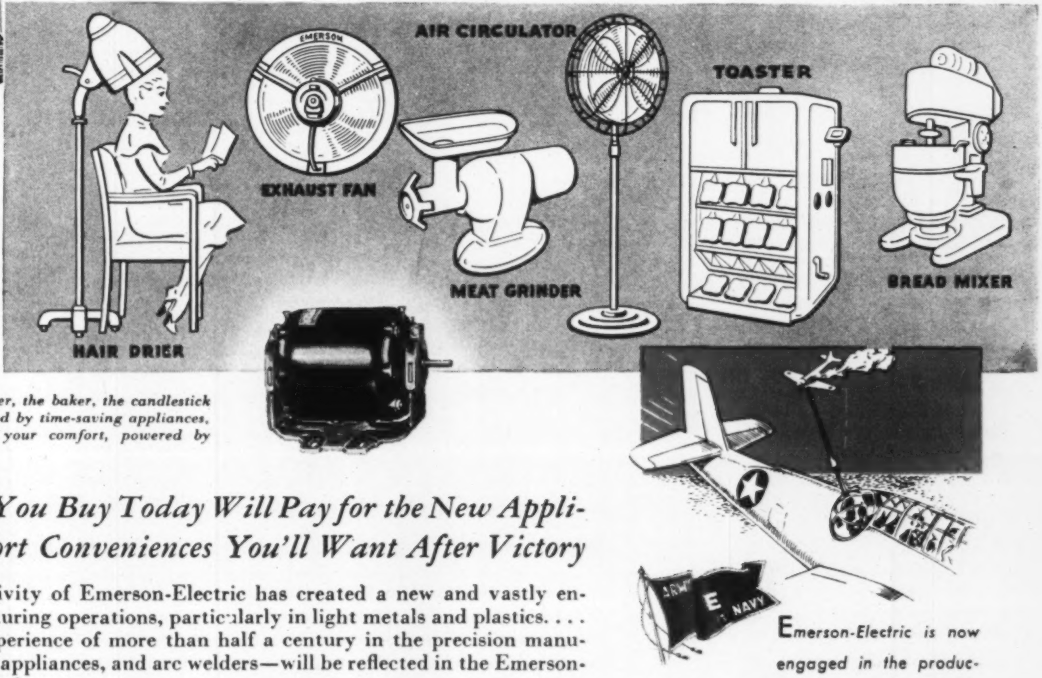
Mechanical Hair Drier,* Powered with *Emerson-Electric Motor*, Dries Heaviest 'Suit' of Hair in 10 Minutes!

This Startling Invention of 1898 Pioneered Another Great American Industry

By the ingenious combination of a gas burner and electric motor-driven blower, heated air was forced through a pipe to the desired elevation. Women marveled at the time saved in drying their hair. The news spread, more shops were opened. Today, a nation-wide industry of equipment and supply manufacturers, distributors and beauty salons serves the women of America.

This is but one of many instances where Emerson-Electric has kept pace with the development of appliances and equipment from inception to their present-day utility.

* *This device was made for Mr. A. F. Godefroy, of St. Louis, an internationally-known authority on beauty culture. An Emerson-Electric announcement of 1898 says "It will dry perfectly the heaviest suit of hair in ten minutes."*



Whenever you visit "the butcher, the baker, the candlestick maker," you'll be better served by time-saving appliances, and equipment provided for your comfort, powered by Emerson-Electric motors.

Emerson-Electric is now engaged in the production of power-operated revolving turrets for United Nations' Bombers, electric motors for aircraft control, shell parts—also electric fans, motors and welders authorized by government priorities.

The War Bonds You Buy Today Will Pay for the New Appliances and Comfort Conveniences You'll Want After Victory

The expanded war activity of Emerson-Electric has created a new and vastly enlarged field of manufacturing operations, particularly in light metals and plastics. . . . This—added to the experience of more than half a century in the precision manufacture of motors, fans, appliances, and arc welders—will be reflected in the Emerson-Electric products of the future.

"After Victory" manufacturers of new and improved motor-driven appliances and equipment will again confidently power their products with Emerson-Electric Motors, based on the latest conceptions of design, construction and efficiency.

THE EMERSON ELECTRIC MANUFACTURING COMPANY
SAINT LOUIS . . . *Branches:* New York • Chicago • Detroit • Los Angeles • Davenport

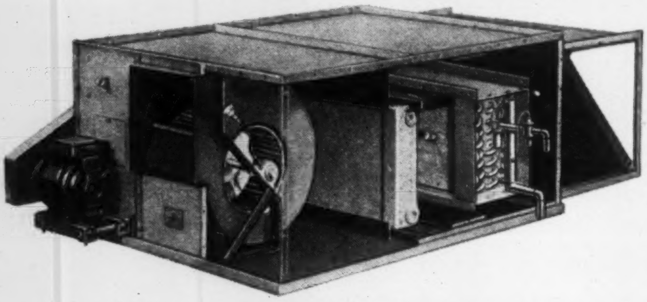
330

EMERSON EMERSON ELECTRIC **ELECTRIC**

MOTORS • FANS • APPLIANCES • A. C. ARC WELDERS

Young

STREAMAIRE



AIR CONDITIONING
FOR VITAL WARTIME NEEDS

Control of temperature, humidity and air circulation for precision production, food preservation and health maintenance is a war-time requirement. So important is this need that Government Agencies will grant priorities for air conditioning equipment to control these factors. Young STREAMAIRE air conditioning units provide the essential elements necessary for proper air treatment, in a completely engineered and tested arrangement. Consult with Young engineers on your specific problem.

YOUNG RADIATOR COMPANY
DEPT. 113-J, RACINE, WIS., U. S. A.

PRECISION PRODUCTION —The need for air conditioning in the manufacture of essential precision instruments, tools or products is recognized as a necessity of tolerance control. It is also approved for the maintenance of workers' health where conditions of unavoidable heat or contamination of air exist.

FOOD PRESERVATION —Air conditioning equipment for handling, sorting and storage rooms, when essential to maintaining the edibility and nourishment content of food will be permitted. Such equipment is particularly valuable in the preparation for processing by dehydration and quick freeze methods.

HOSPITALS and LABORATORIES —Specific authorization is given for air conditioning equipment for research, testing and analytical laboratories; for hospital rooms used for surgical operations, X-ray or critical convalescent treatment: and for the production and storage of drugs and biological products.

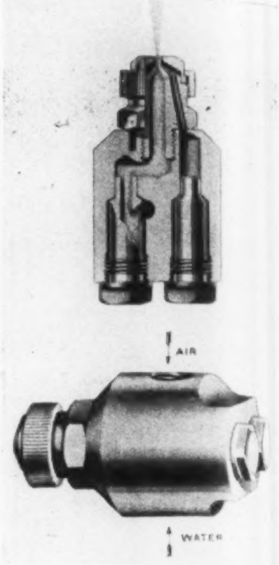
YOUNG *STREAMAIRE* air conditioning units are made in eight horizontal and eight vertical models, with capacities ranging from 400 to 16,625 cfm . . . built for top performance in every size and type of installation. For cooling, heating and air conditioning.

BUY BONDS—PRODUCE MORE
SALVAGE SCRAP—WIN THE WAR

Young

PRODUCT OF Young ENGINEERING AND MANUFACTURING SERVICE SPECIALIZING IN HEAT TRANSFER PRODUCTS

HEAT TRANSFER PRODUCTS
OIL COOLERS • GAS, GASOLINE, DIESEL ENGINE COOLING RADIATORS • INTERCOOLERS • HEAT EXCHANGERS • ENGINE JACKET WATER COOLERS • UNIT HEATERS • CONVECTORS • CONDENSORS • EVAPORATORS • AIR CONDITIONING UNITS • HEATING COILS • COOLING COILS



air are mixed externally to produce a round spray. This spray is projected from 10 to 20 ft depending upon the air pressure.

According to the manufacturer, this nozzle is a complete unit in itself and can be quickly adapted to almost all types of installations. Two monel metal strainers, one for air and the other for water, are included in the body of the nozzle and may be removed for cleaning or replacement without disturbing the nozzle or the lines. All parts of the nozzle are accurately machined of brass and white coated.—Spraying Systems Co., 4031 W. Lake St., Chicago, Ill.

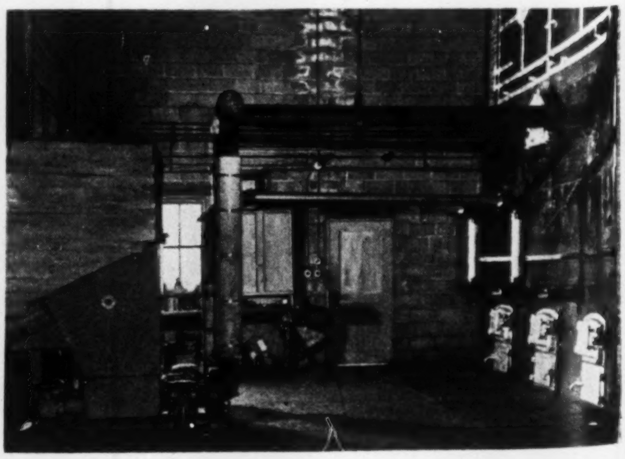
New Line of Vertical Motors

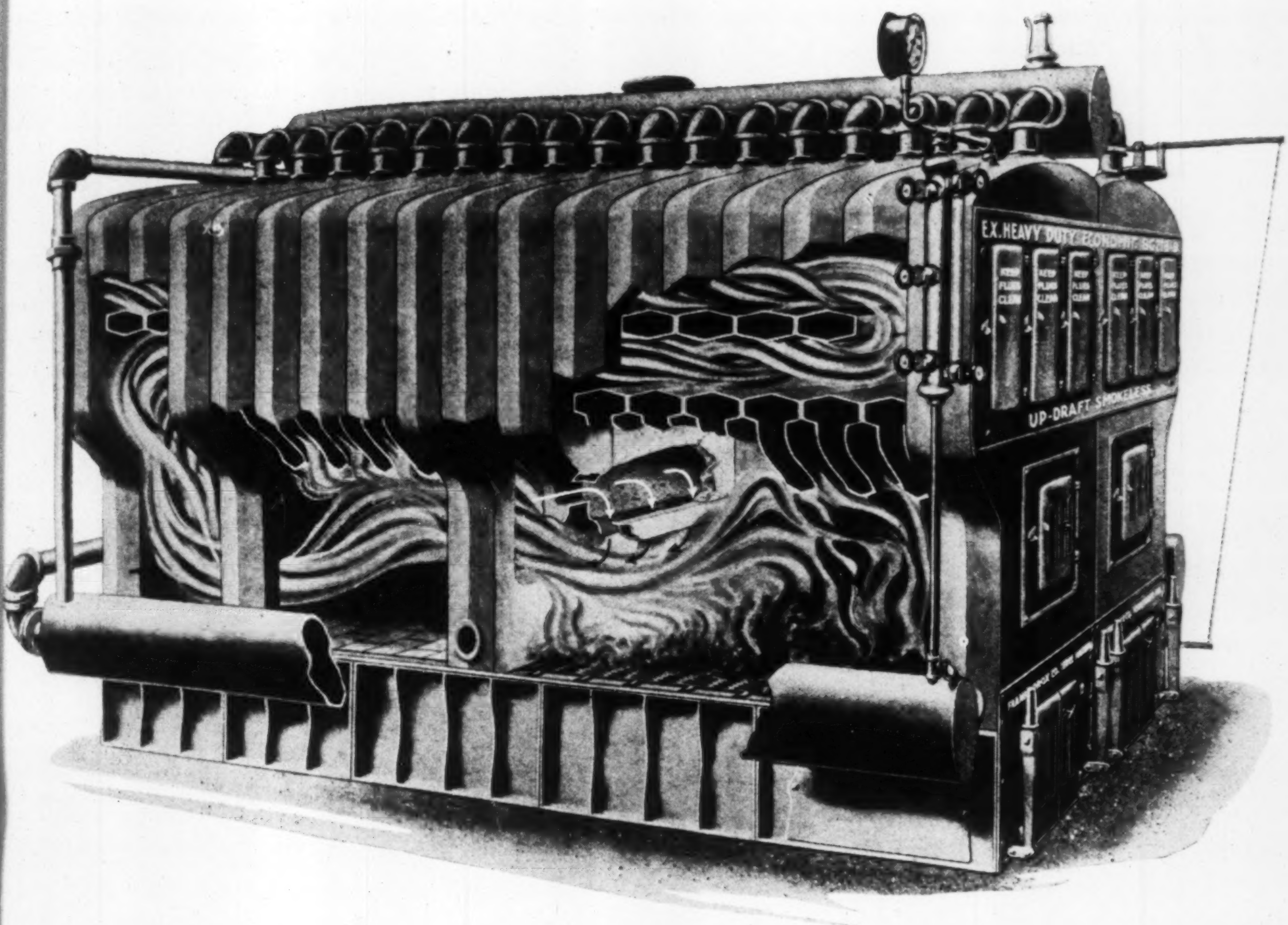
No. 2487—A new line of direct current vertical motors ranging from 40 to 200 hp at 1750 rpm, and in equivalent ratings at other speeds, has been announced. Furnished for both constant and adjustable speeds, they are designed for low thrust, solid shaft applications on pumps, machine tools, and marine under deck auxiliaries. According to the manufacturer, they are also desirable in cases where floor space must be saved or expense of gearing avoided.

The motors are of drip proof protected construction. A special bearing housing prevents grease from entering the motor and damaging the commutator and the windings.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Stoker Used at Dehydration Plant

No. 2488—When the F. B. Huxley & Son food dehydration plant in Ontario, N. Y., was hand fired it used 20 tons of coal a day for processing and heating. A pneumatic spreader stoker was installed and at the same time the load was increased one-third. According to the stoker manufacturer, the coal consumption is now only 18½ tons per day. It is stated that the stoker design makes it easy to operate and adapts it very well to the constant 24 hr load





PROX BOILERS FOR BIG HEATING JOBS

. . . FOR ANY HEATING JOB . . .

Prox Boilers for Continuous Service

WHEN you select and install Prox Boilers, you select and install the best in continuous service efficiency. Prox Boilers are made in 400 to 25,000 sq. ft. guaranteed capacity . . . for any type of fuel . . . coal, oil, gas . . . for hand or mechanical firing.

Prox Boilers have large even sized flues which are easily cleaned. An outstanding Prox feature is its three layer, long fire travel for greatest efficiency and economy.

Write today for complete details on Prox Boilers.

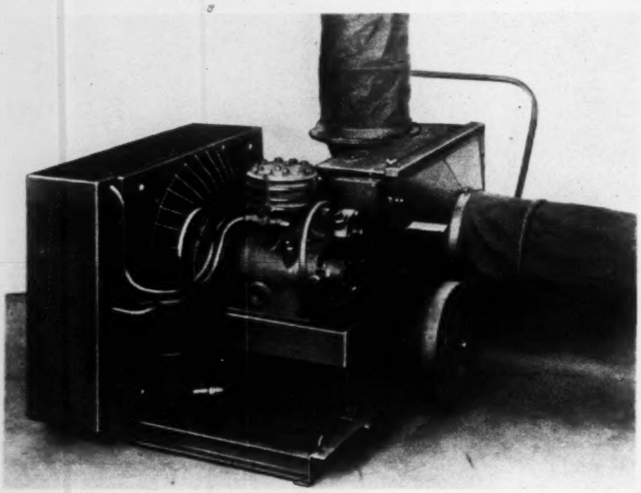
FRANK PROX COMPANY, Inc.

1201 South First Street, Terre Haute, Ind.

The double nozzle spreader conveys coal to a 489 hp water tube boiler. Another advantage of the stoker installation is that it has eliminated the smoke nuisance.—Iron Fireman Mfg. Co., 3121 W. 106th St., Cleveland, Ohio.

Mobile Cooler and Dehumidifier

No. 2489—A mobile cooler and dehumidifier may be used by the armed forces in a variety of operations. For example, when a broiling sun is running temperatures up to 150 or 160 F inside an airplane that must be repaired or serviced, this unit may be used to deliver cooled air through canvas ducts for the comfort and efficiency of the mechanics. Other applications include cooling and dehumidifying dark rooms for speedy developing and printing of aerial and other military photographs, field hospital uses, etc.



This new unit is self-contained and weighs about 600 lb. It has retractable wheels and a sled-like bottom with rings attached for towing it through sand or over soft ground. It cools, dehumidifies, filters, and circulates the air.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Synthetic Rubber Seals Gasoline Tank

No. 2490—Development of a compound made from "Ameripol," a synthetic which will remain so flexible at —70 F that it can be bent at an angle of 90 deg around a ½ in. rod, has been announced. The new compound is being used in the construction of bolted tanks for storage of the high octane gas and aromatic fuels used in military aircraft.

In the construction of these tanks, made from sheet metal, sealing strips of the synthetic rubber 1¾ in wide and 3/32 in thick are placed at the points where the sheets are bolted together. Half inch bolts are used to squeeze the synthetic rubber tightly between the plates, assuring a fuel-tight seal.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Bonding Process for Metals

No. 2491—A method of bonding metal to metal, or rubber, synthetic rubber, plastics, leather or wood to metal, or to each other, with a bond in most instances stronger than the materials themselves, has recently been announced. It is known as the "Reanite" bonding process, and is suitable for use with almost all metals—iron, steel, stainless steel, magnesium, aluminum, aluminum alloys, copper, bronze, and brass.—U. S. Stoneware Co., Akron, Ohio.

KENNARD FINNED COILS

AIR CONDITIONING UNITS ☆

ENGINEERED FOR UTILITY and SERVICE

We have the technical experience and production facilities to solve your problems.

KENNARD STEEL COILS are available either hot dipped galvanized or paint dipped. COPPER COILS available on W.P.B. approval.

HEATING COILS for use with steam or hot water.

COOLING COILS for use with direct expansion refrigerants, cold water or brine.

We offer you the additional advantage of PROMPT DELIVERY

Write for complete information

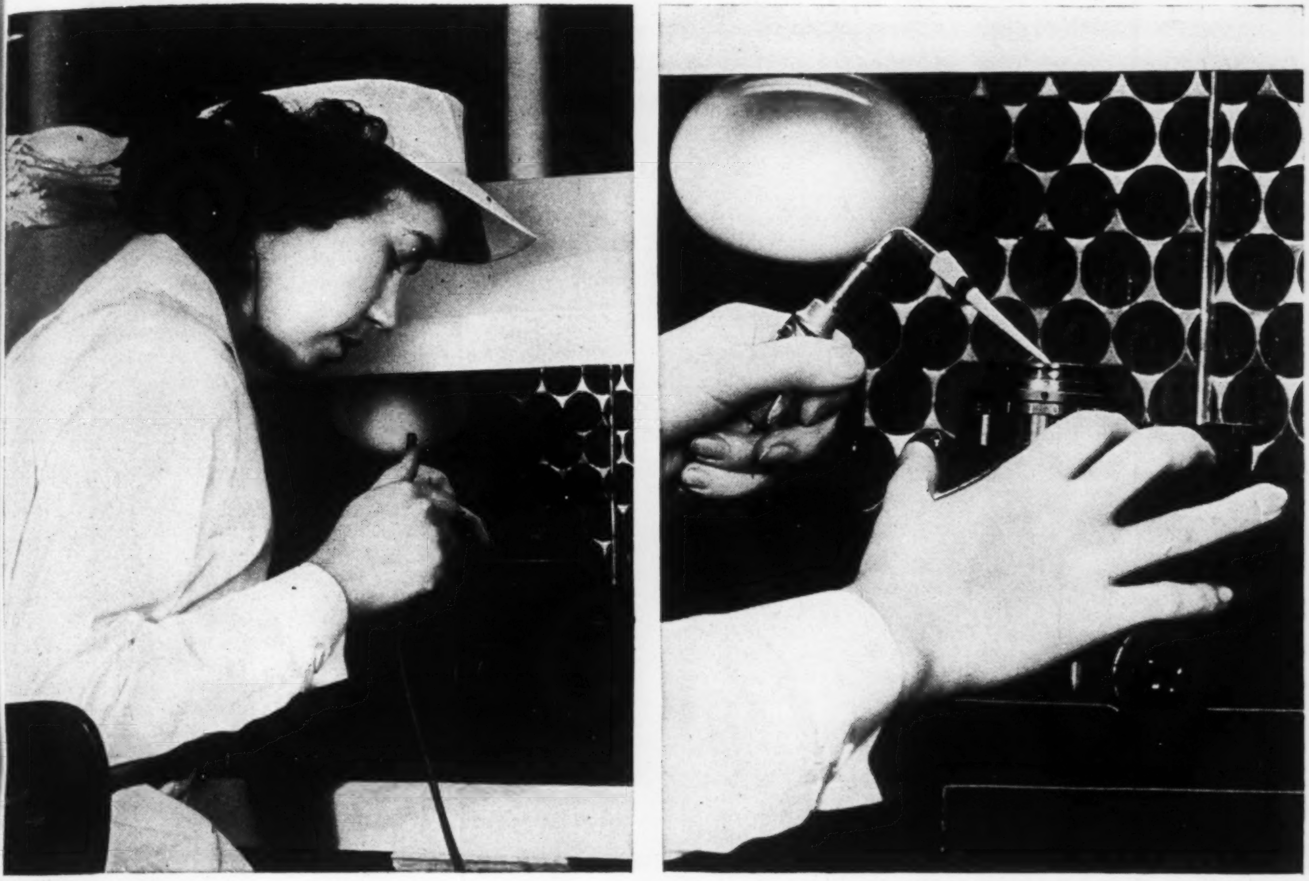
One row all copper steam coil core for use on board ship.

SAM KENNARD INC.

4821 Easton Ave.

ST. LOUIS 13, MO.

☆ REFRIGERATION BLOWER UNITS



Photos Courtesy of Minneapolis-Honeywell Regulator Company

No "bombers" in our gun sights

THIS GIRL is assembling the lenses of an anti-aircraft fire-control device.

The second picture is a close-up of the work. At the back of her work bench, is a Dust-Stop* Air Filter.

Out of this filter a stream of clean moving air blows away any dust that may be floating around above the work bench and prevents it from settling on the lenses she is assembling.

If a speck of dust, even 1/10,000th of an inch in diameter, were to get on one of these powerful lenses, magnification would make it look like an enemy "bomber" to the gun sighter.

More examples . . .

This is only one example of scores of Dust-Stop applications that are helping in the accuracy of manufacture and assembly of delicate instruments and parts.

In scores of war plants, Dust-Stops are today removing grit, grime, and manufactured dusts from the air. They are helping guard the accuracy of bomb sights, tank parts, and numerous other precision instruments and assemblies. The result is fewer rejects.

Surprisingly low in cost

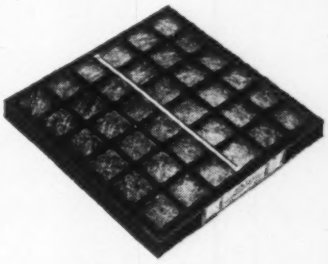
As original equipment for commercial and industrial installations, Dust-Stops cost only about 1¢ per CFM to install. Their replacement cost is less than 1/10th of 1¢ per CFM.

Dust-Stops may also be vacuumed cleaned or gently rapped out to remove excessive surface dust accumulations. This process may be repeated once or twice to reduce maintenance costs further.

●

Yes, Dust-Stops are available. They are made from all-American materials which are not now listed as critical.

Ask your regular supplier about Dust-Stops. If he cannot give you complete technical data, write today to *Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*



FIBERGLAS*

DUSTOP*

*T. M. Reg. U. S. Pat. Off.

AIR FILTERS

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 135. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Acid Regenerated Zeolites

No. 4519—8 p. reprint (27) entitled Predictable Results from Use of Carbonaceous Acid Regenerated Zeolites, by Frank Kemmer and Joseph Thompson. By a series of tests the authors have determined that the effluent of a hydrogen zeolite water conditioning unit before exhaustion may vary from below 40 to 98 per cent of the theoretical acidity equivalent to the sulphate and chloride content. This article explains this variation and shows how such variations can be predicted. The conclusion is drawn that it is no longer necessary to depend upon an average coefficient of exchange in predicting the performance of an acid regenerated carbonaceous zeolite unit, but the characteristics of the effluent can be predicted precisely from an accurate analysis of the raw water and knowledge of the quality of the carbonaceous zeolite. In the present investigation two varieties of carbonaceous zeolites were tested with identical results, and it is quite likely that the same characteristics will be found in other varieties. With such data, equipment can be designed for accurate results.—Cochrane Corp., 3131 N. 17th St., Philadelphia 32, Pa.

Air Eliminators and Equalizing Valves

No. 4520—4 p. bulletin (113) on equalizing valves and air eliminators for automatically fired and hand fired heating systems whose use, according to the manufacturer, will stop fuel waste and eliminate cold rooms. Units for radiators, risers, and mains are described and illustrated, and list prices are given.—Gorton Heating Corp., Cranford, N. J.

Aluminized Steel

No. 4521—Booklet on "Armco" aluminized steel, which comprises a guide to the use of aluminum coated steel and gives gage and weight limits and information on qualities and characteristics. According to the manufacturer, this sheet combines the surface qualities of aluminum with the strength of steel. Physical and chemical properties and welding methods are described.—American Rolling Mill Co., 703 Curtis St., Middletown, Ohio.

Diesel Engines

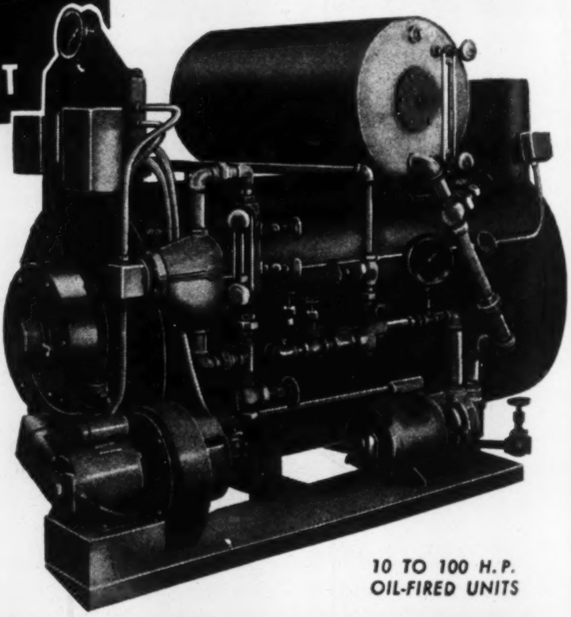
No. 4522—24 p. booklet (3000A) on "diesels for profitable power" giving particulars on design, manufacture, and service facilities applicable to the manufacturer's entire commercial line of marine and stationary diesels. A loose-leaf supplement sheet gives detailed operating cost data for typical municipal plants. A brief history of the manufacturer's background is also presented.—Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

Fan Maintenance and Installation

No. 4523—20 p. pocket size booklet of maintenance and installation data for industrial fans and air conditioning equipment. In easy to read form and with instructive illustrations, the booklet covers the important steps in installation and maintenance and presents recommendations on such subjects as foundations, bearings, rotors, drives, couplings, fan balancing, inspection, cleaning, repairing, painting, safety precautions, etc.—Buffalo Forge Co., 171 Mortimer St., Buffalo, N. Y.

Heat Transfer Equipment

No. 4524—8 p. catalog (143) on heat transfer equipment "for every application", illustrating and describing oil



Here it is—the NEW
Powermaster
O&S STEAM GENERATING UNIT

★ Backed by a half-century of boiler engineering!

Sturdy, compact, lightweight—this fully-automatic unit gives you exceptionally speedy steam production. It develops 100 lbs. pressure from 60° water in 18 minutes—or less! Back of this highly efficient unit is 58 years' experience in boiler engineering and manufacture.

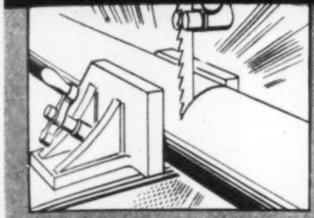
Right now, the new unit is tagged "For Uncle Sam" . . . and some for plants with an AA2 or better. But you will want to investigate now—for the day when Victory makes O & S boilers again available for all purposes.

10 TO 100 H.P.
OIL-FIRED UNITS

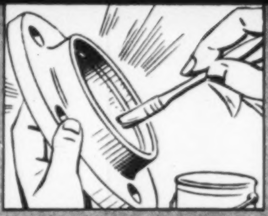
ORR & SEMBOWER INC. O&S Builders of Better Boilers Since 1885
READING • PENNSYLVANIA

USE WALSEAL FLANGES, FITTINGS AND VALVES!

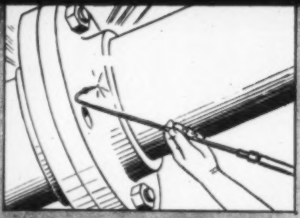
...THE MODERN METHOD OF JOINING COPPER OR BRASS PIPE AND TUBING



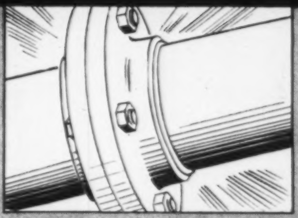
Cut pipe or tubing square, making certain that the pipe is not squeezed out of round or made undersize.



After cleaning flange and pipe carefully, apply flux to the flange recess and to the pipe or tubing.



Expand pipe by heating with the oxyacetylene flame. Next heat section of flange hub; then heat both pipe and flange hub section with wiping motion of torch.



Repeat process on adjacent flange hub and pipe sections. The joint is completed when a fillet of silver brazing alloy shows entirely around pipe at edge of hub.

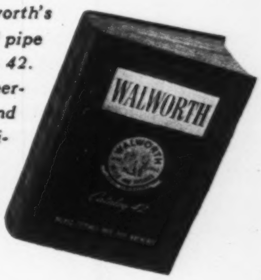
You can save installation time and assure strong, permanent assemblies by using Walseal flanges, fittings and valves. As illustrated in the sketches above, four simple steps connect a flange to the pipe with a silver brazed joint that is tight, leak-proof, and has a corrosion resistance equal to that of the pipe or tubing itself.

Walseal flanges are completely machined, faced, and drilled before brazing so that the assembly is ready to go into the line immediately after brazing. No refacing is required after heating because the relatively low brazing temperatures do not cause any warpage of the flange faces.

Joints made with Walseal flanges, fittings, and valves are not solder joints, but are Silbraz joints. That means that they cannot creep or pull apart under any temperatures to which the pipe or tubing can be safely subjected.

For more complete information on how to install Walseal flanges, fittings, and valves, write for Booklet 84. Address: Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.

You'll find pertinent information on Walworth's complete line of valves, fittings, pipe, and pipe wrenches in the new Walworth Catalog 42. Included are 78 pages of practical engineering data that simplify valve selection and make piping layouts easier. Write, on business stationery, for your free copy. Address: Walworth Company, 60 East 42nd St., New York 17, N. Y. Department 99.

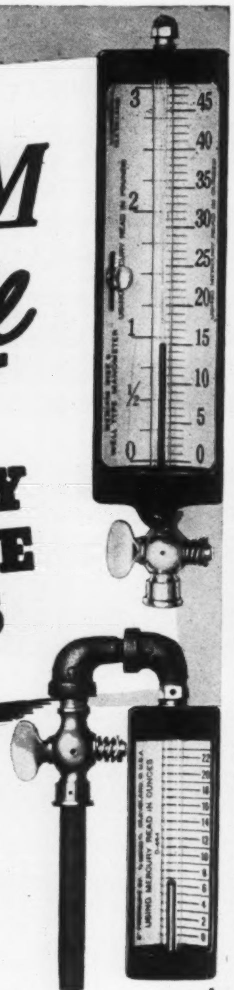


WALWORTH
valves AND fittings

BOSTON WORKS
KEWANEE WORKS

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

MERIAM
non-spill
MERCURY
PRESSURE
GAUGES



★ These accurate, compact, direct reading gauges—either as portable or permanent installations — have a wide application for measuring low range air and gas pressures.

They are designed so that the mercury cannot be lost from the gauge either through spilling or overpressuring. They are available in the 3" and 6" sizes to measure 22 oz. and 48 oz. respectively. Unit scale graduations are in ounces. Each gauge is furnished complete with pet cock and necessary mercury.

Housings of the gauges are of cast semi-steel, accurately machined to insure leak-proof fitting of all the component parts. The housing, finished in dull black baked enamel, protects on three sides the heavy walled Pyrex, centrally located tube. Write for Bulletin 3 containing full details.

THE MERIAM COMPANY
SINCE 1911
1969 West 112th St., Cleveland 2, O.

MERIAM
SINCE 1911

MANOMETERS, METERS AND GAUGES FOR THE ACCURATE MEASUREMENT OF PRESSURES, VACUUMS AND FLOWS OF LIQUIDS AND GASES

temperature regulators, supercharger intercoolers, cabin heating coils, and engine jacket coolant radiators for aeronautical use; products for engine and compressor cooling; large cooling and condensing units; heat exchangers for marine and industrial service; marine heating, cooling, and ventilating units; and products for industrial air conditioning.—Young Radiator Co., 709 S. Marquette St., Racine, Wis.

Industrial Instruments

No. 4525—Bulletin (DM006) containing general information on the manufacturer's line of industrial instruments for controlling and recording wartime processes. It comprises a buyers' guide of air and electric operated controllers, recorders, indicators, and telemetering recorders and controllers.—Bristol Co., P. O. Box 1790, Waterbury, Conn.

Insulation

No. 4526—20 p. booklet on "Kimsul" insulation for protection against heat and cold, giving 10 reasons why this type of insulation should be specified, discussing its advantages, presenting information on the economic thickness of building insulation, and showing how various special applications are handled. There is also a section on vapor seals, telling when they should be used and how they should be installed.—Kimberly-Clark Corp., Neenah, Wis.

Level Control

No. 4527—4 p. bulletin (1100) on floatless level control for liquids and powders, illustrating and describing electronic level controls, their operation, typical applications, etc.—Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass.

Motors

No. 4528—Series of price sheets on squirrel cage induction polyphase motors and splashproof squirrel cage motors, with information on ratings.—Century Electric Co., 1806 Pine St., St. Louis 3, Mo.

Motors

No. 4529*—New simplified buying data in bound and looseleaf form on motor and control equipment. Bound books contain prices, dimensions, application data, and descriptions. The 180 p. motor buying data covers popular types and ratings of motors (up to 100 hp), gear motors and motor generator sets. The 276 p. book of control buying data lists a wide variety of controls and accessories for d-c, single phase, squirrel cage, and wound rotor motors. For use of large scale purchasers, the motor and control looseleaf book contains complete product listings plus information on special features required for specific industries. *Note—Buyers of motors and control can secure copies from the manufacturer's district offices *only*.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Motor Maintenance Equipment

No. 4530—88 p. handbook (143) telling "how to keep motors and generators operating continuously at peak efficiency without dismantling." Among the subjects covered are motor maintenance equipment, industrial electrical equipment, variable speed transmissions, machine tool accessories, and wiring devices and tools.—Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill.

Production for War

No. 4531—20 p. beautifully illustrated booklet telling of the manufacturer's contribution to the war effort with full color reproductions showing such equipment as a 30 ton hydraulic broach operating on tank tracks to tolerances of 0.0005 of an inch; production saws that handle tough alloy steels at precision of 0.015 of an inch; a centerless grinder for grinding alloy steels to an accuracy of 0.0005 of an inch; electric hydrogen brazing, hardening, and

Illinois

PRESSURE REGULATORS

for Steam, Air or Gas

Illinois Pressure Regulators are controlling steam pressures accurately and efficiently, for the Armed Forces from coast to coast in Air Fields, Forts, Navy and Marine Training Centers, Arsenals, Hospitals, and in many war production plants.

The complete ILLINOIS line includes valves for every type of service. They are available in single seat for dead end service, or double seat for continuous flow, and can be furnished in spring loaded, weight and lever or internal pilot type, as service requirements dictate.

Reasonable shipments on suitable priorities

Write for Bulletin No. 107

Fig. 141

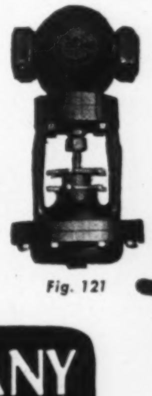


Fig. 121

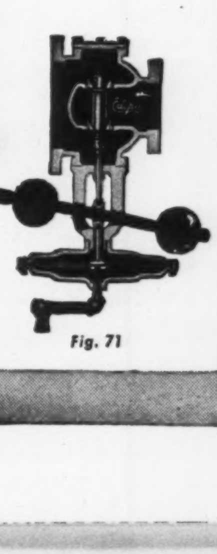


Fig. 71

ILLINOIS ENGINEERING COMPANY

INCORPORATED 1900

RACINE AVENUE AT 21ST STREET • CHICAGO

quenching furnaces; salt bath type hardening furnaces in which small parts are heat treated; etc.—L. J. Mueller Furnace Co., 2005 W. Oklahoma Ave., Milwaukee, Wis.

Radiant Heating

No. 4532—6 p. folder giving a case study of a radiant heating installation in a war plant addition, describing the building and the radiant heating system, which comprises 2300 ft of wrought iron pipe assembled into three banks of grid coils, and giving information on temperature control, performance, cost, and why radiant heating was chosen for the building.—A. M. Byers Co., Clark Bldg., Pittsburgh, Pa.

Rings for War

No. 4533—24 p. catalog devoted specifically to ring making and forging as applied to war products, and placing particular emphasis upon rings that are rolled, welded and sized, a method which "effects substantial savings in material and cost as compared with the same rings made in one piece by the conventional methods." For over fifty years the manufacturer has made the well known "Dresser" pipe coupling, consisting of three steel and two rubber rings. The "experience developed in the production of this item is now being used in making thousands of unusual rings for the war effort," from both ferrous and nonferrous material.—Dresser Mfg. Co., 490 Fisher Ave., Bradford, Pa.

Rust Prevention

No. 4534—8 p. issue of Lubrication (vol. 29, no. 7) devoted to rust prevention and describing how rusting develops, the types of rust, methods of rust prevention, development of rustproofing materials, etc.—The Texas Co., 135 E. 42nd St., New York, N. Y.

Stampings and Tank Heads

No. 4535—88 p. handbook comprising a buyer's guide for stampings and tank heads, supplemented with various useful mathematical tables and formulas. There are sections on the manufacturer, the products and how to buy them, tank heads and tank accessories, standard steel shapes, stampings, and technical data.—Commercial Shearing & Stamping Co., 1775 Logan, Youngstown, Ohio.

Valve Recognition

No. 4536—Series of valve recognition charts, 9½ x 12¼ in., "designed to take the mystery out of valves for the many new maintenance workers in industry today." Valves are broken down into four basic types and the charts explain what service each type performs, how it operates, and where it is used. Flow characteristics of each valve and symbol sketches are shown.—Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.

Valve Reseating Tools

No. 4537—Circular describing renewable seats and reseating tools for valves, faucets, bibbs, etc.—Economy Valve Seat Co., 2617-25 Fletcher St., Chicago, Ill.

Welders' Guide

No. 4538—20 p. vest pocket booklet (EW-95) explaining and illustrating what is wrong with different types of faulty welds and how to correct the faults. Essentials of the proper welding procedure are explained and there is a trouble check chart for welding machine troubles, with other useful data.—Hobart Brothers Co., Troy, Ohio.

Weld Symbol Hammer

No. 4539—4 p. bulletin describing a combination weld marking tool and chipping hammer which features a keyed symbol in the form of alphabetical and numerical combinations or distinctive outline symbols which are available in combinations to place permanent and definite responsibility for every weld and to identify individual welders in crews. Marking tips are interchangeable and bits are replaceable at the chipping end.—Atlas Welding Accessories Co., 307 Boulevard Bldg., Detroit 2, Mich.

Thomas A. Edison

UNIT HEATER CONTROL VALVE

AUTOMATIC — BALANCED — PACKLESS — THROTTLING

An entirely different type of completely Automatic Temperature Control for regulation of the Steam Supply,

Holds Temperatures Within 1°F in Standard Equipment, Closer on Special Order.

FIVE TYPES AVAILABLE

If it's heated with steam, there's probably an Edison Valve to control it. May we tell you how it works, how simple, durable, fool-proof it is, why it requires no attention whatever, where it is being used?

BUY WAR BONDS

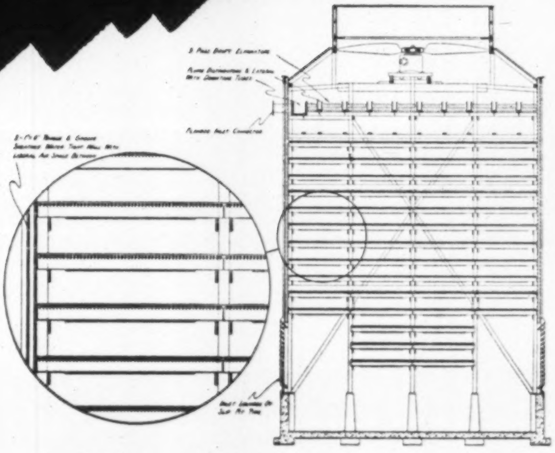
ASK FOR BULLETIN V13

Thomas A. Edison, Inc., Instrument Division, West Orange, N. J.

COLD FACTS of LILIE-HOFFMANN LEADERSHIP MECHANICAL DRAFT TOWERS

Compare! Material for material, method for method, performance for performance, cost for cost... then you have undisputed proof of Lilie-Hoffmann leadership.

Representative
LILIE-HOFFMANN
Applications
are in operation in synthetic rubber plants, major oil refineries, and the chemical industry throughout the nation and abroad.



End Elevation of Induced Draft Tower

INCORPORATING RECOMMENDATIONS OF U. S. FOREST PRODUCTS HANDBOOK

TECO TIMBER CONNECTORS DEVELOP 100% WORKING STRESS OF MEMBERS

LOW PUMPING HEAD

OPEN FLUME CONSTRUCTION GRAVITY TYPE DISTRIBUTION

MAXIMUM WATER BREAKDOWN FOR QUICK TEMPERATURE DROP

NEW DESIGN OF FILLING REDUCES STATIC PRESSURE

All Sizes... All Types!

Forced and Induced Draft, Atmospheric Deck, Combination Spray and Deck

LILIE-HOFFMANN COOLING TOWERS, *Inc.*

4239 DUNCAN AVE. ST. LOUIS, MO.
TWO PLANTS FOR QUICK SHIPMENT
ST. LOUIS, MO. and PLAINVIEW, TEXAS

AA-5 Rating for Heating Repairs and Conversion Assigned by Amended P-84; L-79 Revised

The War Production Board's preference rating order P-84, as amended August 21, assigns an AA-5 rating, in place of the former A-10 rating, for emergency heating and plumbing repairs. According to the order, the ratings it assigns "are to be used only to obtain materials, equipment or parts needed in replacements of plumbing equipment or heating equipment worn out, damaged beyond repair, or destroyed, or to repair such equipment because of an actual breakdown, or for conversion parts." The ratings "may not be used to replace useable equipment or to make a substitution which would provide more extensive facilities than are necessary to replace the equipment, part or parts worn out, damaged or destroyed." The ratings may not be applied to obtain any rationed equipment contrary to any OPA ration order.

The order assigns a preference rating of AA-5 and the symbol MRO to deliveries to a seller of steel and wrought iron pipe and steel sheets for repairs.

Before the seller applies the AA-5 preference rating for repair items or conversion parts he must secure from the consumer a certification in substantially the following form signed manually or as provided in priorities regulation 7 by the consumer:

> I hereby certify that the items included in this purchase are needed by me to replace equipment worn out, damaged beyond repair or destroyed, or to repair such equipment because of an actual breakdown or for conversion purposes. I further certify that the use of the repair items will not provide more extensive facilities than now exist.
>
> Address of installation..
> Consumer's signature ....
> Address ....

Heating equipment as defined in the order includes "electrical heat controls."

"Conversion part" is defined in the order to mean any component part, other than a stoker, required to convert oil burning or gas burning equipment to solid fuel burning equipment.

All communications regarding this order should be addressed as follows: Plumbing and Heating Division, War Production Board, Washington, D. C., Ref: P-84.

General limitation order L-79, covering plumbing and heating equipment, was also amended on August 21 and provides that on and after September 1 no person shall deliver or accept delivery of plumbing and heating equipment except on an order rated A-10 or higher, except items the cost of which to the purchaser is not more than $5.00, equipment for a project for which authority to begin construction has been given on form WPB 2032 (formerly PD-443), power driven coal stokers approved on form WPB 1612 (formerly PD-668), oil burners approved on form WPB 2727, equipment rationed by a certificate issued by a local war rationing board, equipment which has been previously used by a consumer, steel and wrought iron pipe, and certain other items.

L-79 also includes as heating equipment "electrical heat controls."

NAM Survey Reveals Products of the Future

Your postwar, vitamin fortified breakfast bun may be sprinkled with synthetic cinnamon, you may live in a prefabricated country cottage with plastic thread window screens, and you may helicopter to work a hundred miles away, according to the National Association of Manufacturers, in a booklet entitled Testimony to the Future.

The booklet summarizes the results of a survey.

Among new developments reported in the building field were such things as plastic "wire" for window and door screens, new laminated gypsum products, improved rock wool insulation, prefabrication of major home heating equipment, and a trend toward standardization of structural elements as contrasted with former standardization of complete designs for American homebuilders "who resist architectural regimentation."

WECO-N. G. E. Series F600
GAS BURNERS

These burners are available for ratings from 50,000 to 10,000,000 B.t.u. output, for use in heating boilers, power boilers—in any metal firebox or sectional boiler.

Featuring flexibility to meet various firebox shapes and sizes at various gas pressures, and low draft loss. Full automatic controls that operate properly can be easily applied.

GUARANTEED
VIBRATIONLESS

This burner operates on straight natural gas and mixed gas to 800 B.t.u. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

THE WEBSTER ENGINEERING CO.
TULSA —DIVISION OF— **OKLAHOMA**
Surface Combustion . . . . Toledo, Ohio

MERCOID
SWITCH
MAX. PRESS 100 LBS. DO NOT EXCEED
MIN. DIFF. 5 LB.
LBS. PRESSURE
0 20 40 60 80 100
HIGH
LOW

THE BIG JOB

Mercoid Controls are still being built and sold though the volume is almost entirely on industrial types. These carry the highest war priority and find their way into war plants everywhere throughout the country, where they are doing their important part in the big job of essential production.

AUTOMATIC CONTROLS FOR HEATING, AIR CONDITIONING, REFRIGERATION AND NUMEROUS INDUSTRIAL APPLICATIONS

MADE BY THE MERCOID CORPORATION, 4229 BELMONT AVENUE, CHICAGO 41, ILLINOIS

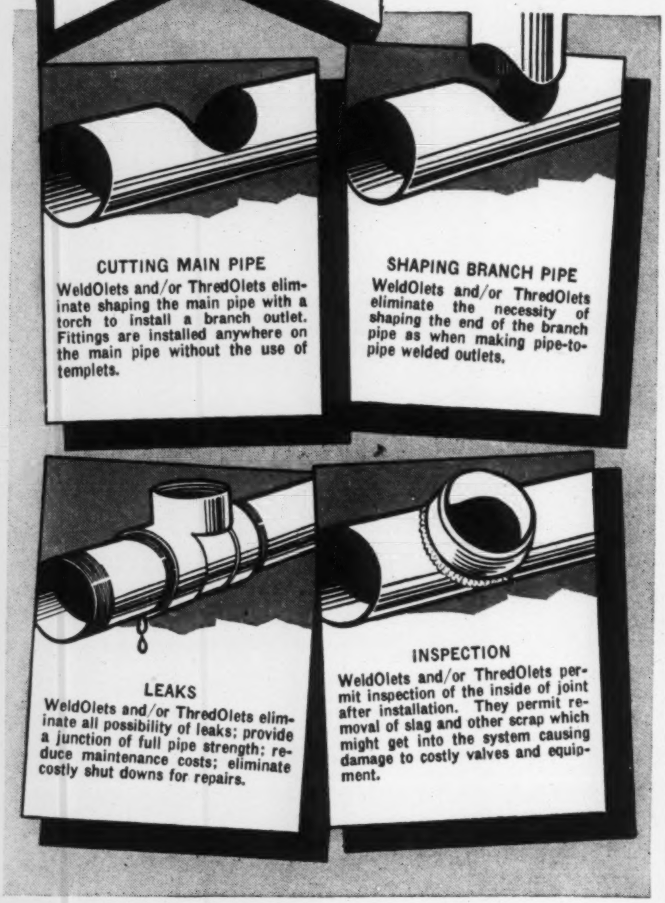
Make Good Piping Better with WELDOLETS · THREDOLETS

3 Types Meet Every Need

WeldOlets for butt welded branch connections.

ThredOlets for screwed branch connections.

Socket-End WeldOlets for socket-type welded branch connections.



CUTTING MAIN PIPE
WeldOlets and/or ThredOlets eliminate shaping the main pipe with a torch to install a branch outlet. Fittings are installed anywhere on the main pipe without the use of templets.

SHAPING BRANCH PIPE
WeldOlets and/or ThredOlets eliminate the necessity of shaping the end of the branch pipe as when making pipe-to-pipe welded outlets.

LEAKS
WeldOlets and/or ThredOlets eliminate all possibility of leaks; provide a junction of full pipe strength; reduce maintenance costs; eliminate costly shut downs for repairs.

INSPECTION
WeldOlets and/or ThredOlets permit inspection of the inside of joint after installation. They permit removal of slag and other scrap which might get into the system causing damage to costly valves and equipment.

WeldOlets, ThredOlets and Socket-End WeldOlets are suitable for all commonly used pressures and temperatures in every type of piping system. They are installed either before or after erection of the main line—and always with ease and economy. They are equally well adapted to prefabricated or "on-the-job" assemblies. Because of their patented, funnel-shaped intake aperture they improve flow conditions. Carried in stock for all standard pipe sizes up to 12" in size-to-size or reducing sizes—and can be furnished on special order in sizes up to 24". Stock fittings are drop forged steel, but to meet special conditions will be supplied in Monel, Everdur, Toncan Iron, wrought iron, etc.

Bulletin WT31 gives detailed information about all the advantages of WeldOlets, ThredOlets and Socket-End WeldOlets. Write for a copy today.

Forged Fittings Division
BONNEY FORGE & TOOL WORKS
ALLENTOWN, PA.

Star Awarded July 10, 1943

WELDOLETS · THREDOLETS
Welded Outlets for Every Piping System

$10,000 Apartment Heating Design Competition Opened

Apartment design and construction, dormant since the start of the war, was stimulated into activity September 4 when the Minneapolis-Honeywell Regulator Co., 275 Fourth Ave., S., Minneapolis, Minn., announced a $10,000 competition for the best heating designs submitted by contestants.

Using a hypothetical six story apartment building, prizes will be awarded for designs of a system of steam heating and its control, and a system of hot water heating and its control, John E. Haines, manager of the company's air conditioning controls division, said. "Contestants will assume that the design of the apartment building has progressed architecturally to the point where it is now necessary to prepare its heating layout," he said.

An independent research corporation, at the instigation of Minneapolis-Honeywell, surveyed approximately 100 apartment dwellers in New York City, Chicago, Brookline, Mass., and St. Louis, Mo., Haines said. The test survey disclosed that 84 per cent of people living in apartments believe that it is either necessary or desirable to have their own control over the amount of heat being supplied to their personal living space.

"Personalized apartment heating represents the latest advance in apartment design," Haines said, "and after the war will be as common as the electric refrigerator which has become an integral part of all apartment houses." Advantages to owners and occupants of this type of heating include greatest tenant health, comfort and convenience, reasonable first cost and low operating and maintenance costs, he stated. "Postwar apartment dwellers will not have to open windows in zero weather to cool off, nor will they have to call the janitor for more heat. The thermostat in each apartment or room will maintain temperatures at the point selected by occupants."

"Personalized apartment heating will be of considerable advantage to apartment house owners and operators because apartments will be more easily rented and the added tenant satisfaction will result in longer leases," he pointed out. "The survey showed that the desire for personalized heating was so great that 48 per cent of the people interviewed were willing to pay an average of $5 a month additional rent for individual apartment heating control."

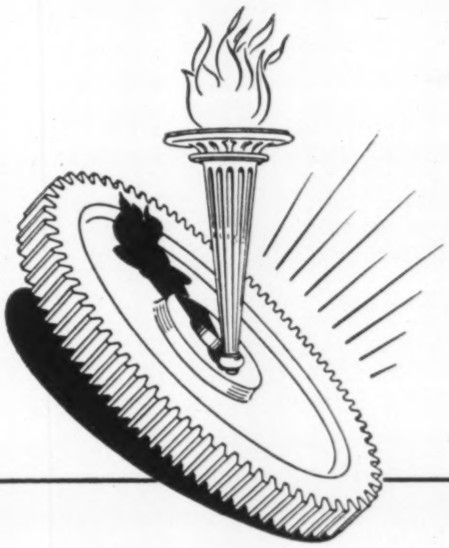
Tests run by the National District Heating Association on a number of large buildings showed that automatic control systems of this type provided an average fuel saving of 18 per cent, Haines continued.

Detailed instructions with complete architectural layouts will be provided each contest entrant, together with an informative booklet describing personalized apartment heating. Any person, except company employees, may enter the contest simply by writing to the main office here, Haines said. Separate prizes will be awarded for the best solution based upon a system of forced hot water heating and a system of steam heating. First prize in each group will be $2000, second prize in each group will be $1000 and third prize will be $500. In addition, there will be 20 honorable mention prizes of $150.

All entries will be judged anonymously by a jury consisting of a nationally recognized consulting engineer, a nationally recognized architect, and a representative of Minneapolis-Honeywell, he added. The contest will be closed November 15, 1943.

Heating Engineers on List of Critical Wartime Occupations

Professional or technical engineers are included in the list of critical occupations issued by the War Manpower Commission August 14. This list covers skills urgently needed in the war effort; workers possessing such skills must get into war industry or supporting civilian activities by October 1 or lose further claim to Selective Service occupational deferment. It is specifically stated that mechanical engineers specializing in the heating or refrigerating engineering fields are included.



Business Must Be Free — For Free People

★ We in this country have enjoyed the "Four Freedoms" for so long that perhaps we forget the existence of these Freedoms — and their maintenance through the years — has been largely the economic result of a Free Enterprise System.

When business is free to plan ahead, to dare, and to risk with faith in the future — with faith in the possibility of a reasonable profit, all the people benefit! When the imagination and inventive genius of industry can forge ahead with new production methods, develop new products, and invade new markets — then mass employment and the Four Freedoms are assured.

Free Enterprise, spurred on by the Profit Motive, and operating under our traditional American Way of Life, has constantly raised the living standards of millions, created new jobs, kept wages and salaries rising, and cut the cost to the consumer of goods produced.

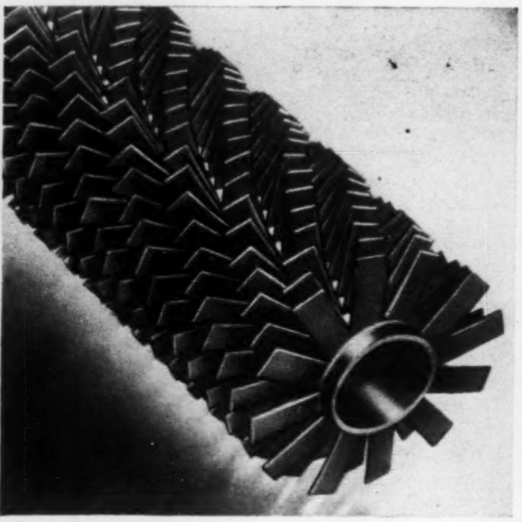
No dictator ever arose in a healthy, prosperous civilian economy. None ever will. Only industrial stagnation breeds those unhealthy forces of discontent that alone lead men to the destruction of their own Four Freedoms.

Industrial progress promotes Freedom, when industry in turn is free of hampering government regimentation. Government must *encourage* industrial progress, not handicap its development. Repression is foreign to the conception of free people. And, because appreciation comes only from knowledge and understanding, we in Industry must explain these benefits of Free Enterprise to those who may not understand them today.

CURTIS REFRIGERATING MACHINE DIVISION
of Curtis Manufacturing Company
1950 Kienlen Avenue • St. Louis, Missouri

FOR VICTORY
BUY
UNITED STATES
WAR
BONDS
AND
STAMPS

Commercial Refrigeration and Air Conditioning Equipment



All Steel

NOW—
Helically Wound Fins
WELDED to tubes

WELDED for increased efficiency*
WELDED for greater durability
WELDED for unvarying performance

TILCO-FIN
the extended surface tubing with
"DUAL EFFICIENCY"
—High heat transfer
Welded extended surface tubing provides extremely high heat transference.
—Low resistance
Finned surface furnishes much less resistance to the passage of air than accepted standards.

*In a recent shell and tube heat exchanger application, Tilco — Fin's new Weld-On steel tube was found to have 94% of the effectiveness of the original all prime copper surface. The change to Weld-On tubes from bare copper tubes increased the output of the same shell 258%.

TILCO-FIN, INC., 68 SECOND AVE., BROOKLYN 15, N. Y.

What Temperature Can Be Maintained Under Fuel Oil Rationing Program?

THE EDITOR—

I was attracted to the article of the above title by J. K. Peebles, Jr. in the March, 1943, issue of HPAC, in view of his honest effort to secure a simple equation between degree days and oil consumption. This he has endeavored to do by setting up a ratio of degree days and applying his results to oil consumption. This would be interesting if possible.

"Open for Discussion"

When Mr. Peebles wrote his article, he overlooked the fact that a degree day is a comparative figure and has no relative significance unless coupled with other factors. For this reason, any results obtained by using degree days only cannot be correct when applied to either coal, oil or gas.

In the first place, no consideration has been given to the number of days in the heating season. If you assume 210 days to the heating season, you get one result and if you use 240 days, you get another result.

Also, suppose you endeavor to arrive at oil consumed per degree day. Oil consumption varies in accordance with the outside temperature, intensity of the cold, and wind pressure. A heating plant is invariably more efficient in extreme cold under full load than in mild weather, therefore, the gallons of oil per degree day is greater in mild weather than in extreme cold weather.

Again on what kind of heating system should figures be based—warm air, hot water, or steam? Gallons per degree day are dependent on the type of heating system and its efficiency. Also, the character of the building enters into the calculations we might make. If the radiation in all buildings had been calculated on the same basis, radiation could be used as a factor. We will all agree that no two buildings are alike in radiation unless that radiation has been figured by the same individual.

This all resolves into one fact, that is, any attempt to arrive at a given temperature within a building with a given percentage of reduction of fuel oil using degree days only as a basis is purely a guess.

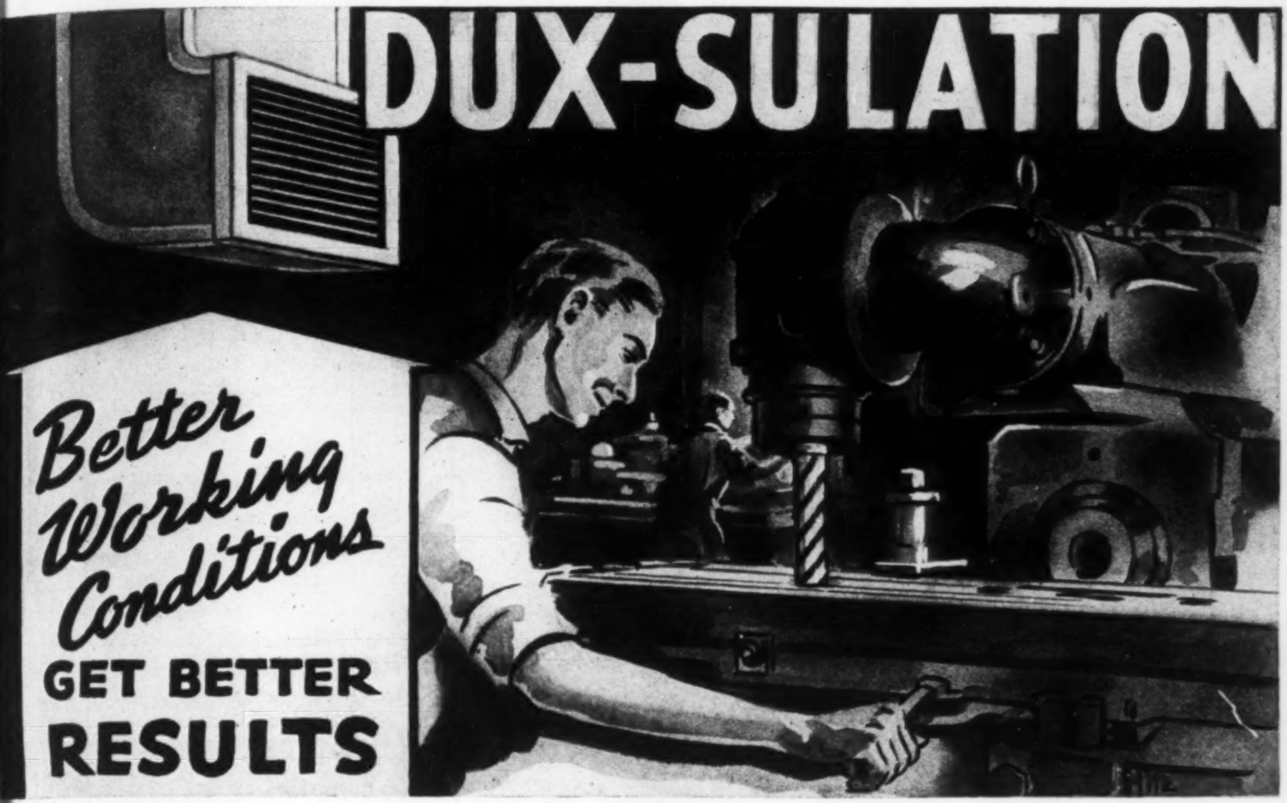
We have already experienced a season of theoretical oil rationing in which we have seen allotments as low as 10 per cent of the normal usage in 1941-42 to as high as 110 per cent. Also, the consumer has been told the allowable temperature he can maintain.

Each case is an individual problem and if the owner wants to shut off part of his building and keep warm or is satisfied with lower temperatures throughout the building, that is his problem.

By this time the government has fairly accurate figures of the amount of fuel oil consumed for heating and commercial use in the 1941-42 heating season. With this information the amount of oil that will be saved by making a flat cut of 10, 20, or 30 per cent is known.

A horizontal reduction would be fair to all, will give a definite pattern to work to, and would certainly sim-

DUX-SULATION

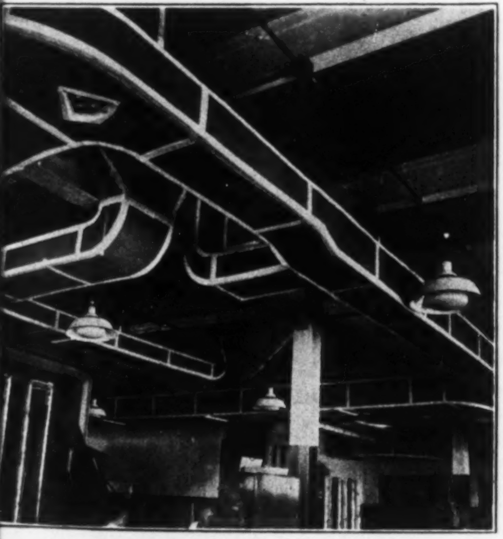


Increased Man Power and Top Efficiency

are obtained by having "Sound Conditioned" Ducts, and "Conditioned Air" in office, laboratory and plant.

DUX-SULATION (asbestos protected) the all-purpose insulation, when applied to outside of metal ducts helps control temperatures at lower fuel and power cost and lower maintenance cost. Dux-Sulation also deadens metallic sounds, and when applied to inside quiets air borne noises.

A flexible insulating blanket ½" thick having a K factor .27 B.t.u. Comes complete with corner tape and adhesive for cementing on to sheet metal duct work. Dux-Sulation comes 36" wide in a roll containing 100 square feet. Easy to apply and a very efficient insulation against temperature losses, condensation and noise travel. Will not rot, chip or crack.



A finished Dux-Sulation job—attractive and efficient.

DUX-SULATION can easily be applied to your existing air conditioning duct work without interrupting its operation and without inconvenience. Requires no maintenance and lasts indefinitely.

Dux-Sulation can be given any type of surface treatment and is attractive when installed.

Preserve your Ducts, don't let them RUST by ordering Asbestos Protected DUX-SULATION today from your local Heating Supply House.

Immediate shipment in any quantity. Get the most out of your Air Conditioning System.

Write for Bulletin No. 407-H

4101 WEST
TAYLOR ST.
GRANT WILSON, INC.
CHICAGO
ILLINOIS

An Engineer's View-
of freedom from
trap troubles!

DEPENDABLE performance — that's what an engineer looks for in a steam trap. Tens of thousands of Armstrong traps being used in industry are proving the advantages of their rugged simple design in providing efficient, trouble-free service. Here are a few Armstrong features translated into what they mean in freedom from trap troubles:

1. **"FREE FLOATING" VALVE** — *no binding or sticking . . . opens wide . . . positive action.*

2. **SELF-SCRUBBING ACTION** — *swirling water carries all ordinary dirt and scale right on through.*

3. **AUTOMATIC AIR ELIMINATION** — *a vent removes air from the system and discharges it with condensate.*

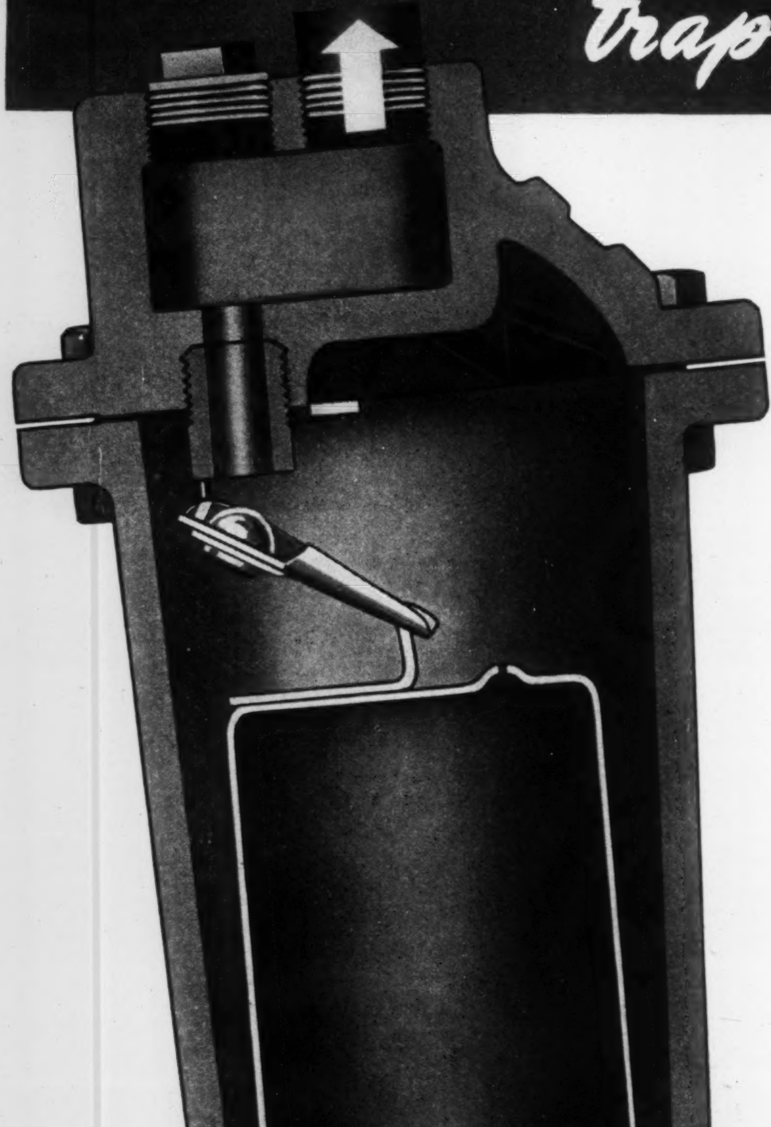
4. **LONG LIFE PARTS** — *mechanism made of special alloys reinforced at points of wear . . . chrome steel valve and seat.*

Armstrong traps are available in a wide range of side inlet and bottom inlet styles for virtually every condensate drainage job. Write for catalog.

ARMSTRONG MACHINE WORKS
874 Maple Street Three Rivers, Mich.

ARMSTRONG INVERTED BUCKET STEAM TRAP TRADE MARK

ARMSTRONG STEAM TRAPS



---

plify the
a definite
I belie
perature
fuel.—C.
mercial

THE EDIT
Thanks
my articl
If the
it is adm
the proba
two-third
guess. H
practicall
considera
It is r
figure and
degree da
eration t
and outs
average
heat cont
plant, an
It will
for deter
ence betw
temperatu
the respe
this meth
length of
example
ture of 70
of heatin
temperatu
there are
ture belo
length of
All of t
exception
including
as well a
heating p
care of b
fuel consu
as a facto
can be ma
While i
ticular pl
very wide
flected in
is true t
than norm
the avera
ever, whe
tions in r
running a
off, it doe
seasonal
the propos
perature
Mr. Ha
why a hor
under the

plify the administration of fuel oil rationing, and save a definite amount of oil.

I believe this is the problem and not how low a temperature a man must live in to cut a given percentage of fuel.—C. H. HAGEDON, S. E. Fenstermaker & Co., commercial engineers.

THE EDITOR—

Thanks for sending me Mr. Hagedon's comments on my article on the fuel oil rationing program.

If the facts as set forth by Mr. Hagedon were true, it is admitted that the proposed method of determining the probable temperature that can be maintained with two-thirds of the normal supply of fuel oil would be a guess. However, Mr. Hagedon overlooked the fact that practically all of the questions raised are taken into consideration in the proposed method.

It is recognized that a degree day is a comparative figure and that in determining fuel consumption, by the degree day method, it is necessary to take into consideration the heat loss of the structure, the design inside and outside temperature, the difference between the average inside and average outside temperature, the heat content of the fuel, the efficiency of the heating plant, and the number of heating hours.

It will be noted that the method used in my article for determining the degree days takes care of the difference between the average inside and average outside temperature by using a base temperature 5 F below the respective probable inside temperature and that this method automatically takes into consideration the length of heating season involved. In the particular example given in the article, with an inside temperature of 70 F and a base temperature of 65 F the length of heating season is 246 days, whereas, with an inside temperature of 65 F and a base temperature of 60 F there are only 215 days with a normal mean temperature below 60 F and, therefore, in this latter case the length of heating season is only 215 days.

All of the other necessary factors, with the possible exception of difference in efficiency of the heating plant, including normal intensity of cold and wind pressure as well as the character of the building and type of heating plant, referred to by Mr. Hagedon, are taken care of by the fact that they are all reflected in the fuel consumption for the normal season, which is used as a factor in arriving at the probable temperature that can be maintained.

While it is recognized that the efficiency of any particular plant will vary with the load, this load has a very wide variation during a normal season and is reflected in the fuel consumption for a normal season. It is true that when maintaining a temperature lower than normal the average efficiency will be different from the average efficiency during a normal season. However, when it is recognized that most fuel oil installations in residences operate on an intermittent schedule, running at full capacity for a while and then cutting off, it does not appear that the difference in average seasonal efficiency would introduce a serious error in the proposed method of determining the probable temperature that can be maintained.

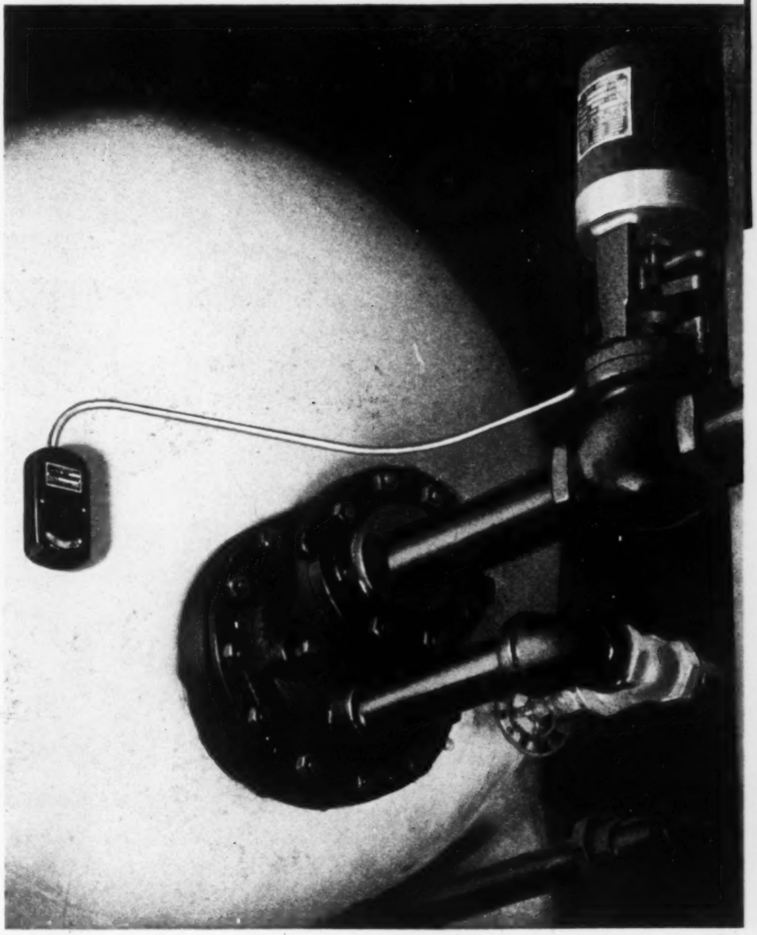
Mr. Hagedon himself points out a very good reason why a horizontal reduction in fuel oil would not be fair under the emergency. He refers to the fact that allot-

BARBER-COLMAN

GRILLES & REGISTERS
AIR DIFFUSERS

MAXIMUM SERVICE
Controls
by
BARBER-COLMAN COMPANY
MINIMUM MAINTENANCE

AUTOMATIC
CONTROLS



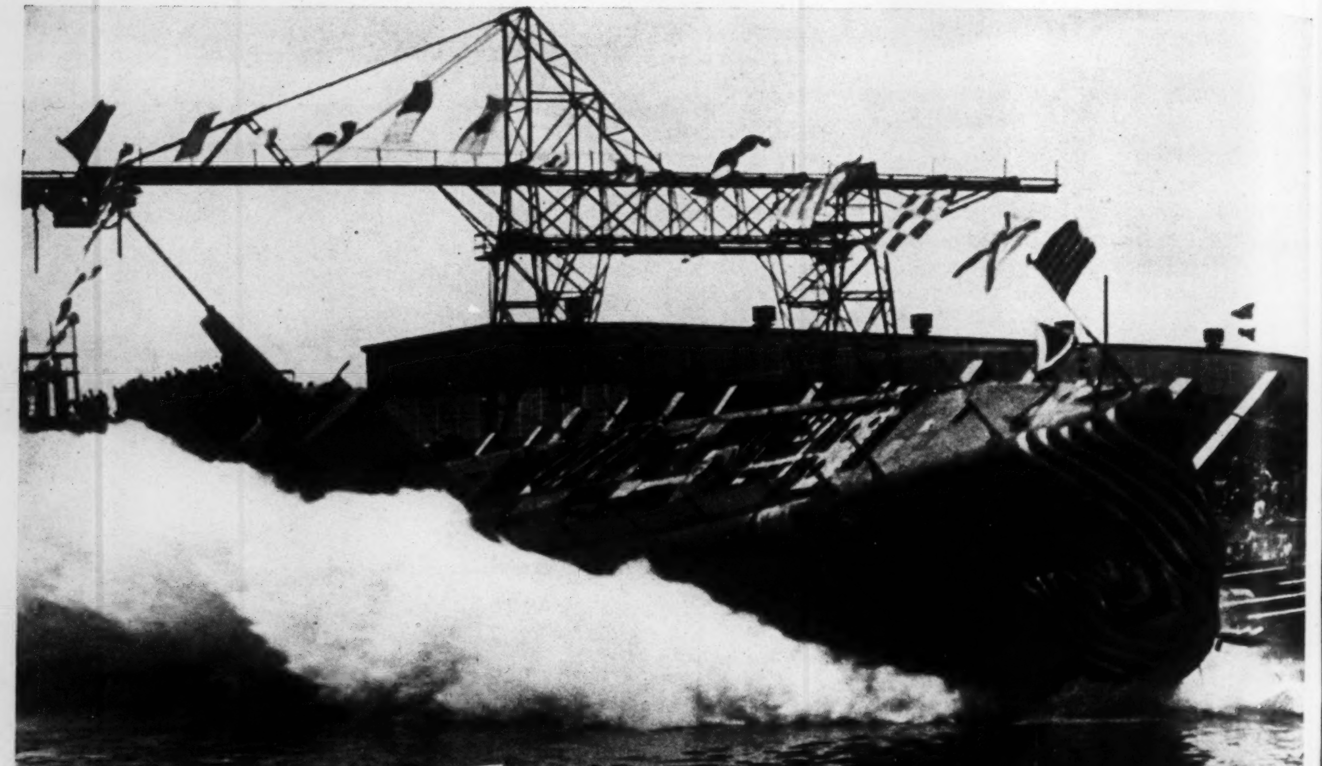
AUTOMATIC CONTROLS FOR HOT WATER STORAGE

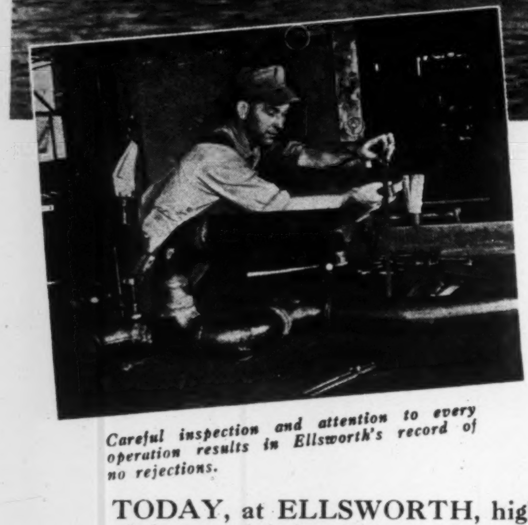
★ The storage of an adequate supply of hot water for washing and other purposes presents a problem of temperature control as well as of proper size and distribution of tanks. Actually, a control installation on each of a number of tanks will usually reduce the operating cost over the installation of a control on the central supply alone. Barber-Colman control equipment has demonstrated its ability to provide accurate maintenance of water temperature in storage tanks.

WATER KEPT HOT AT MINIMUM EXPENSE

★ With a simple BARBER-COLMAN CONTROL, consisting of a Thermostat in the tank and a Motor-Operated Valve on a steam supply line, the water in each tank is automatically maintained at the desired temperature. Heat losses from water supply lines are reduced to a minimum and the amount of steam used is also kept at a minimum by the automatically-operated valve. Once the thermostat is set, practically no attention is required for either adjustment or maintenance. BARBER-COLMAN equipment is quality-built throughout to assure a long life of dependable operation.

BARBER-COLMAN COMPANY
1228 ROCK STREET
ROCKFORD, ILLINOIS





Careful inspection and attention to every operation results in Ellsworth's record of no rejections.

Ellsworth Piping

AHEAD OF SCHEDULE

HELPS SHIPBUILDING TO FASTER PRODUCTION

TODAY, at ELLSWORTH, high quality piping, prefabricated in steel, wrought iron, brass and copper, in every size, type and shape, is moving out to wartime shipyards all over the country. Highly praised by Government Officials and Shipbuilders alike for its high standard of workmanship (no rejections) ELLSWORTH PIPING is being delivered far ahead of schedule to keep up the fast ship production pace so necessary to Victory.

We're proud to be able to serve our Maritime Commission, Navy and Army in the production of vital parts for destroyers, escort vessels, cargo vessels, invasion barges, lighters, sea-going tugs, submarines, and other war equipment. Years of development, reseach, progress lie behind today's production achievement at ELLSWORTH . . . Years spent improving manufacturing facilities, technical knowledge, skill and craftsmanship . . . Culminated today in the greater task and the greater responsibility of aiding fighting peoples to freedom.

For today's urgent needs, or tomorrow's plans, whatever your prefabricated piping needs may be, CONSULT ELLSWORTH for prompt and efficient service.

"You Get More 'WORTH' from ELLSWORTH"

Fabricators of Tubular Products, 1/8" to 24" O.D.—Bending—Welding—Cutting—Threading—Drilling and Tapping. Manufacturers of Ellsworth Quality Nipples.

ELLSWORTH PIPE and SUPPLY Co.

MILWAUKEE 3, WISCONSIN

ments have been as low as 10 per cent of the normal usage in 1941-1942. If the building referred to was heated to its normal temperature throughout the 1941-1942 season, it would not be possible, under the regulations, to have the allotment cut to 10 per cent unless the building far exceeded the reasonable maximum area allowed per person.

A typical example of the injustice of a flat cut was brought out by Joel Dean, chief of the fuel oil rationing division of the Office of Price Administration, at the Senate investigation proceedings in January of this year. Mr. Dean cited a house in the District of Columbia which used 26,000 gal. of fuel oil the preceding year. The ration issued the past season was 6000 gal. A flat cut to two-thirds would have allowed 17,333 gal. or 11,333 gal. over the amount allowed. This excess would take care of 28 families using the typical space heater consuming 400 gal. per season. Where such large areas per person are involved, the use of part of the dwelling can be discontinued to insure minimum livable temperatures in the used parts with the oil allowed. This class of owner is also financially able to convert his plant if he desires to do so in order to have the full use of his house.

While there were several administrative defects in the ration regulations the past season, the principle was fair and provided fuel oil to maintain livable temperatures consistent with minimum requirements.

The local ration boards have the computations for the physical characteristics of every oil heated house and, except where the number of occupants has changed, the rations for next year can be the total ration as shown on the computation for the particular dwelling, without any further computations. Even where the number of occupants has changed, the correction of the calculations will be a relatively simple matter. The local boards are familiar with present methods and it would have been shortsighted indeed to change the general method of rationing for next season. Any radical change would have involved a tremendous amount of work requiring manpower which is not available. Any such procedure appears entirely unwarranted since the present system appears to be entirely equitable.

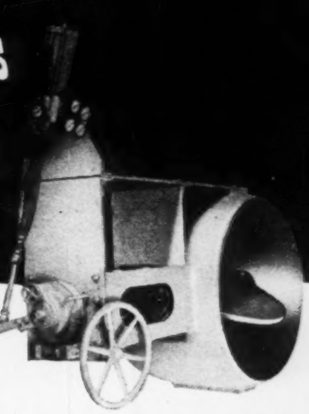
As far as the question of the government knowing the amount of fuel oil saved, upon various necessary cuts, the figures should be available for the past season and any additional cut or increase desired could be based upon these figures.—J. K. PEEBLES, JR., Baskerville & Son, architects.

HE EDITOR—

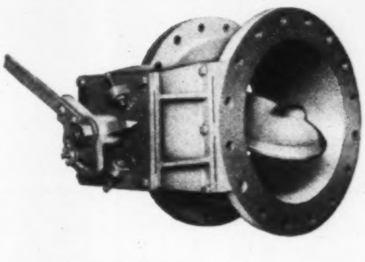
I still believe that the principal question involved in his discussion is the amount of fuel that would be aved by cutting from 70 F inside temperature with a 5 F base to a 65 F inside temperature with a 60 F base.

I have 1941-42 figures on fuel consumption in an dianapolis residence where a constant temperature f 70 F is maintained throughout the heating season. he heating system is a two pipe vapor system with onvector radiation and a stoker fired boiler. The fuel is ke. The following figures are split up in short periods s this indicates delivery dates of fuel, making possible me interesting observations:

Unequaled Flow Characteristics Low Pressure Loss and Maintenance



36-inch valve with welding end, carbon-moly body and four to six per cent chrome-moly vane. Equipped with alloy shafts and bushings, finned lubricated stuffing box and hydraulic cylinder with positioner. The auxiliary heavy duty hand wheel control is equipped with self-locking worm and gear and declutching unit.



Standard 125 lb hand lever operated valve. Can be equipped with hand wheel, chain lever or chain wheel. An extension shaft is provided for inaccessible locations.

A glance at the design of an R-S Butterfly Valve indicates that there is practically no restriction to the flow. The carefully-machined body bore and streamlined vane offer minimum resistance. In fact, the flow conditions are similar to those produced in a venturi tube with high pressure recovery on the downstream side.

It is apparent that the pressure loss in a wide open R-S Butterfly Valve is considerably less than in most conventional types of wedge gates. Add to this the fact that there are no pockets to collect sediment. When the vane approaches a closed position, the valve tends to clean itself.

Shut-off is accomplished by the beveled vane which wedges tight against the valve body. Four to six revolutions of a hand wheel completely open or close the valve vane. Accurate control and shut-off by hand or automatic equipment is a simple matter.

Where hard wear and severe stresses are encountered, the use of R-S "A" metal will produce outstanding results and increased service. Specify R-S Butterfly Valves for reduced maintenance.

R-S QUALITY PRODUCTS SINCE 1908

15 to 900 psi
for air, gas, steam, liquids and semi-solids

Catalog No. 16-B contains detailed specifications. Write for your copy.

VALVE DIVISION
R-S PRODUCTS CORPORATION
132 Berkley Street • Philadelphia 44, Penna.

R-S Streamlined BUTTERFLY VALVES

Heating Period	Days	Lb Fuel per Deg Day	Deg Day 70 F Ins. 65 F Base	A	Deg Day 65 F Ins. 60 F Base	B
Sept. 1 to Oct. 3....	32	8.3	31	14	8	12
Oct. 3 to Nov. 10....	38	8.25	400	5	264	5
Nov. 10 to Nov. 28..	18	8.2	344	1	263	2
Nov. 28 to Dec. 19..	21	5.5	522	..	417	..
Dec. 19 to Jan. 5....	17	5.2	545	..	460	..
Jan. 5 to Jan. 16....	11	5.5	481	..	426	..
Jan. 16 to Feb. 2....	17	6.	489	..	404	..
Feb. 2 to Feb. 17...	15	6.1	492	..	417	..
Feb. 17 to Mar. 4...	16	5.4	555	..	480	..
Mar. 4 to Mar. 21...	17	8.8	326	1	246	1
Mar. 21 to Apr. 13...	23	7.2	397	1	296	3
Apr. 13 to June 1...	49	13.6	213	27	103	18
	274		4795	49	3784	41

First let me say the above degree day figures were taken from the reports of the U. S. Weather Bureau and should be accurate. From the above figures, you will find the difference between the number of degree days, 70 F inside, 65 F base, and 65 F inside, 60 F base, is 1011 degree days or a 21.2 per cent reduction.

In column A are the number of days requiring heat in which no degree days are shown for the normal 70 F to 65 F and in column B are the number of days for the 65 F to 60 F calculations. When you consider that in the heating season of 1941-42 there were 49 days requiring heat that had no degree days and 41 days on the basis of 65 F to 60 F, you will have a factor that cannot be overlooked.

If you will refer to the column showing the pounds of fuel per degree day, you will see how this factor reacts on the fuel consumption. What this would do to the 21.2 per cent reduction can't be figured easily, but we do know it would make a further marked reduction.

After arriving at the percentage of reduction based on degree days, we still don't know whether the fuel consumption would follow the same curve.

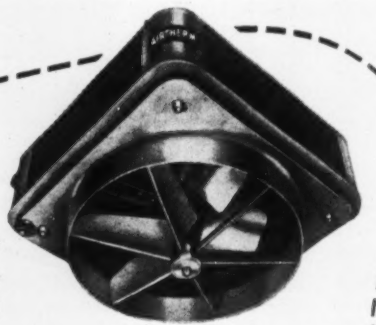
You can readily see that the actual figures do not fall in line with the figures secured by Mr. Peebles through his comparison of degree days only and would indicate that a 33⅓ per cent reduction in fuel would mean a considerable lower temperature than 65 F. It would be interesting to know actually just how low a temperature would have to be maintained in a home normally carrying 70 F in order to stay within a 33⅓ per cent cut. Possibly Mr. Peebles has had some definite actual example which would clear up this point.—C. H. HAGEDON.

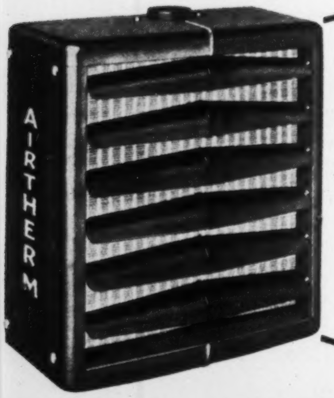
THE EDITOR—

I have read Mr. Hagedon's further comments with much interest. In order to facilitate the study of this data, I have computed therefrom the average degree days per day for each period based upon a base of 65 F. These results are tabulated below along with the average pounds of fuel per day for the respective periods.

	Ave. Deg Day per Day	Lb Fuel per Deg Day
Sept. 1 to Oct. 3	1.0	8.8
Oct. 3 to Nov. 10	10.5	8.25
Nov. 10 to Nov. 28	19.1	8.2
Nov. 28 to Dec. 19	24.9	5.5
Dec. 19 to Jan. 5	32.1	5.2
Jan. 5 to Jan. 16	43.7	5.5
Jan. 16 to Feb. 2	28.8	6.0
Feb. 2 to Feb. 17	32.8	6.1
Feb. 17 to Mar. 4	34.7	5.4
Mar. 4 to Mar. 21	19.2	8.8
Mar. 21 to Apr. 13	17.3	7.2
Apr. 13 to June 1	4.3	13.6

If these figures demonstrate a relationship between the efficiency and the load, a more accurate idea of this





AIRTHERM
UNIT HEATERS

FOR VERTICAL DELIVERY

Insist on These Quality Features When You Buy Heaters in War Times!

Extra-heavy tube-wall thickness of .065".

Ingot iron tubes.

Lead-alloy coated condensers for greatest possible protection from corrosion.

Condensers guaranteed to withstand steam pressure up to 150 lbs. per sq. in.

FOR HORIZONTAL DELIVERY

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. · ST. LOUIS, MO.

SOMETIME (SOON?)

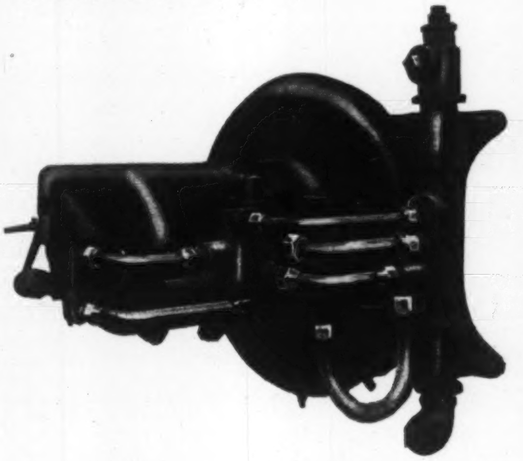
PETRO

REG. U. S. PAT. OFF

OIL BURNING SYSTEMS

will be available once more for normal business.

Their "Oil Miser" economy will contribute much to post-war efficient operation at low cost.



Automatic, semi-automatic or manual operation using No. 5 (or lighter) oil —or No. 6 (Bunker "C") oils, preheated. Capacities to 145 gallons per hour. 487 boiler H. P.—68,000 sq. ft. steam.

Even war-time research has not discovered any method of heavy oil combustion that equals or improves Petro's Thermal Viscosity principle of automatic firing at constant efficiency.

As a principle of design and operation, rather than a mechanical part, it can't wear out or break down. It cuts "service" as well as operating supervision.

Petro Engineers are working on postwar plans with a lot of Contractors. Can they help you?

OIL IS AMMUNITION USE IT WISELY

Full data on Petro Industrial Burners are in our Catalog—see Sweet's or Domestic Engineering Catalog Files—or we will gladly send copies on request.

PETROLEUM HEAT AND POWER COMPANY

Makers of Good Oil Burning Equipment Since 1903

STAMFORD CONNECTICUT

quick delivery

EXPLOSION PROOF

condensate pumps

Immediate delivery

from stock on Sterling EXPLOSION-PROOF CONDENSATE PUMPS, in varying sizes and capacities.

Standard types

of condensate pumps for high and low pressures.

All sizes and types

Many sizes of Standard Condensate Pumps are also available for shipment on short notice.

Take advantage of this NOW for important replacements. Can ship on A-10 priority. For further information and quotations, write

sales department

STERLING, Inc.

4015 N. Oakland Ave. Milwaukee 11, Wis.

KNOW
AIR CONDITIONING

AIR CONDITIONING FOR COMFORT

Send Today
for
Samuel R. Lewis'

"AIR
CONDITIONING
FOR
COMFORT"

Third Edition
288 Pages—Illustrated
$2.00

Here is a book that presents—in simple, readily understandable form—every kind of information necessary for an accurate and thorough knowledge of air conditioning principles, equipment, and practices. Written by S. R. Lewis, a widely-known consulting engineer who has been active in air conditioning work for more than thirty years, it deals with all angles of the air conditioning subject from the practicing engineer's viewpoint. The designing procedures explained in the book are, for example, in every detail the same procedures employed today by the author's own organization.

Featuring this third edition are several entirely new chapters on phases of the subject not previously treated, including noise control, air conditioning measurements, air conditioning standards, fire protection codes and operating suggestions. Brand new designing examples are also used, together with new forms for recording the design data, the proper filling-in of which is explained step-by-step.

OF VALUE BOTH AS
A REFERENCE AND TEXT

Engineers in air conditioning will find the new "Air Conditioning for Comfort" invaluable as a reference book, while salesmen, students, and others may rely on it to give them a clear knowledge of fundamentals, and of the latest air conditioning methods and equipment.

Send for a copy today. We know you will consider this volume the most readable and complete book on the air conditioning science you have yet seen. You will risk nothing in ordering a copy, for you will be privileged to return it for a refund if for any reason it should prove unsatisfactory. Order your copy now.

KEENEY PUBLISHING COMPANY
6 N. Michigan Ave. Chicago 2, Ill.

relationship will be obtained if the first three and last three periods are disregarded, for the time being, and a study made for the period of November 28 to March 4, thereby confining the discussion to that part of the season when heat was probably required constantly and extra days of heating are not involved.

Under these conditions one would expect to find the greatest efficiency during the period with the greatest average degree days per day. An analysis of the figures shows the same fuel consumption for 24.9 and 43.7 average degree days per day. Likewise, there is a jump from the minimum consumption of 5.2 pounds of fuel per degree day to maximum consumption of 6.1 pounds for a change of only 0.7 in the average degree days per day.

From the above, it is apparent that the data do not substantiate a claim of greater efficiency during this part of the season, when operated at a room temperature of 70 F as compared with 65 F.

It is recognized that the fuel consumption per degree day would be greater at the beginning and end of the season due to a very light load at times. Here again, the data do not bring out any direct relationship. One has only to compare the consumption of 8.3 pounds of fuel per degree day for an average of 1 degree day for the period with the consumption of 13.6 pounds of fuel per degree day for an average of 4.3 degree days.

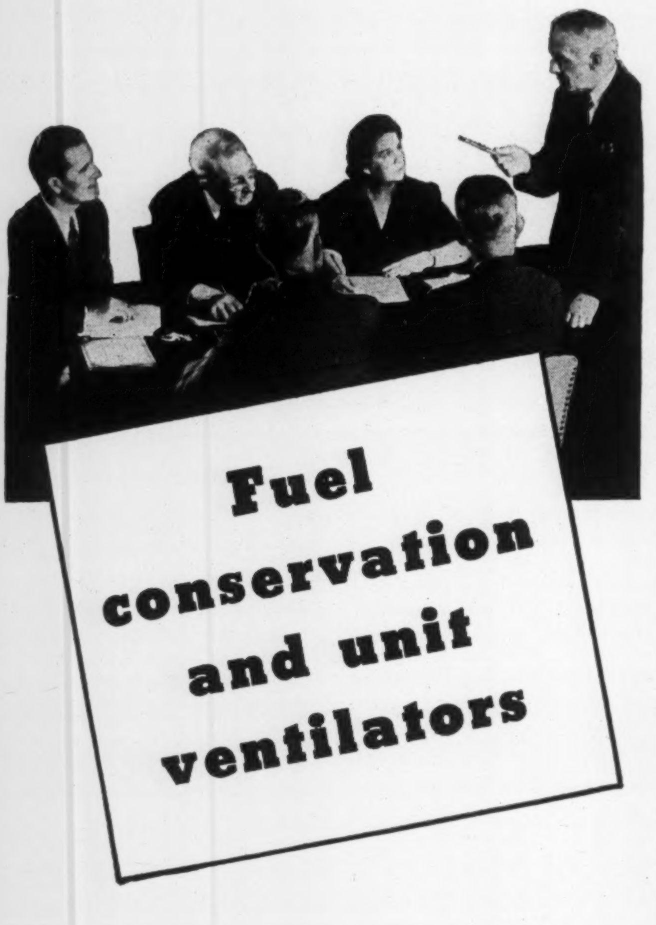
I do not contend that the relative efficiency is not involved when operating at a reduced maintained temperature. However, it does not appear that it has any marked effect and, therefore for the matter under consideration, the efficiency can well be neglected and the fuel consumption based upon the number of degree days under the two conditions.

As for the extra days involved I wish first to call attention to the fact that there is apparently some error in the tabulation since two reliable sources at my disposal show that the normal heating season for Indianapolis extends from September 23 to May 22 and, under these conditions, there could be no extra days involved in October, November, March or April and only 9 in June. If it is assumed that the number of extra days is correct, it is interesting to note that the numbers of such days for a 65 F base and a 60 F base are almost directly proportional to the degree day relationship and therefore apparently would have little, if any effect upon the results.

From an analysis of degree day data it will be found that for cities with approximately the same number of degree days per season, the reduction in the number of degree days for any given base other than 65 F is approximately the same. From the ASHVE Guide it will be noted that the degree days for Indianapolis and New York are practically the same, being 5321 and 5290 respectively. It would therefore be expected to find the reduction in degree days, when using a base of 60 F, to be approximately the same for the two cities. It will be noted from the example that this is 22.1 per cent for New York as compared with 21.2 per cent given by Mr. Hagedon for Indianapolis.

The close agreement of these figures is very interesting since Mr. Hagedon's figures are based upon a season 10 per cent warmer than normal and approximately 10 per cent longer than normal. These data bring out the fact that the percentage variation in

---



COLD WEATHER will again find School Authorities struggling with the problem of fuel conservation.

Fortunate are those whose schools are equipped with Herman Nelson unit ventilators which operate in accordance with the Her-Nel-Co Method. These units when properly controlled introduce air from out of doors only when necessary for maintaining proper temperatures in the classrooms. They save all of the fuel formerly used to heat large quantities of cold air continuously introduced from out of doors even when not required.

Herman Nelson facilities are now engaged in producing equipment to hasten victory. With peace, we will resume the designing, developing and pioneering of equipment to provide better school room ventilation at less cost.

Herman Nelson Unit Ventilator

Sales and Service Offices in Principal Cities

The Herman Nelson Corporation MOLINE ILLINOIS
Autovent Fan & Blower Division, Chicago, Illinois

Manufacturers of
QUALITY HEATING, VENTILATING AND AIR CONDITIONING PRODUCTS

degree days is substantially the same for an abnormal and for a normal season, thereby further confirming the accuracy of the method proposed in my article.

Mr. Hagedon does not give sufficient data to compute the degree days for room temperatures below 65 F but by comparison with the New York data it appears that a temperature of approximately 62 F could be maintained in Indianapolis during a normal season with two-thirds the normal supply of fuel oil required to maintain 70 F and that if extra precautions are taken in the form of keeping the burner in first class operating condition, weatherstripping, etc., a somewhat higher temperature could be maintained.—J. K. PEEBLES, JR.

Ickes Says Coal Shortage Certain

There won't be sufficient coal to keep war industries going at capacity production and homes comfortably warm next winter, Secretary of Interior Harold L. Ickes, who also is Solid Fuels Administrator, declared in a signed article in Collier's last month. The lag in coal production was attributed to intermittent strikes in the nation's soft and hard coal mines by Mr. Ickes, who fears even greater loss of tonnage because of Congress' failure to continue the Guffey stabilization act which expired on August 23.

To Study Surplus War Plants and Supplies

Immediate and continuing consideration of the postwar problem of war surplus plants and supplies is proposed by the United States Chamber of Commerce, Washington, D. C., through formation of a special business men's committee on the subject.

The first meeting of the group, known as the special committee on utilization of war plants and surplus property, will be held in Washington September 9 and 10. At that time, a preliminary survey of the scope and extent of the problem will be made. An invitation has been extended to business men to bring to the attention of the committee phases of the problem that are of particular concern to them. Communications should be addressed to T. W. Howard.

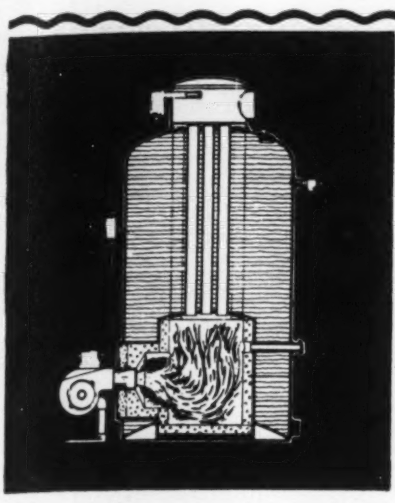
In a statement outlining the purposes of the committee, the chamber said:

"Even before military operations reach their greatest intensity, the war agencies are finding that they have excess stocks of some kinds of war material and supplies. The accumulation of such stocks is inevitable in a highly mechanized war. New weapons, redesigned facilities, and necessary changes in the fighting man's equipment make obsolete munitions and supplies previously in use.

"As the war goes on and comes to a close, the problem of the disposition of surplus property will become increasingly important.

"There will be the problem, at the end of the war, of the proper and efficient utilization of the great special-purpose manufacturing plants.

"Looking ahead at the immensity of these problems and in the recognition that they will affect nearly every field of business, the national chamber has set up a strong committee which will undertake immediately preliminary consideration of the entire subject and devote itself continuously to specific problems as they arise."



AQULUX

Heavy Duty

WATER HEATERS

Four types of Heavy Duty wartime Aqulux Heaters are being built: the Vertical Self-Storage (shown above); the Vertical Nominal Storage; the Horizontal; and the Vertical-Horizontal. They operate at Efficiency Ratings of approximately 80% in spite of the fact they are built without insulation, jackets or galvanizing in order to conserve vital materials.

Take a buying tip from Uncle Sam when you want low-cost HOT WATER!

Buy AQULUX! That's what he is doing. And he ought to know . . . he's providing billions of gallons monthly for the Army and Navy alone. His hot water supply *has* to be dependable. It has to be inexpensive. And it has to operate under the toughest working conditions that exist.

When Uncle Sam installs an Aqulux Water Heater in a Military Hospital . . . in an Army Mess Hall . . . or on board a fighting ship he knows what it will do, for he has checked its performance. He knows he is buying hot water as cheaply as it can be produced for the job in hand. He knows he is putting in equipment that will deliver at maximum efficiency through years of severe usage.

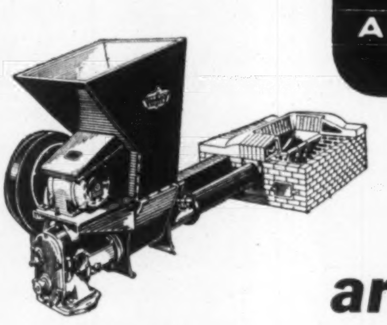
If you have a water heating problem . . . immediate or future . . . we suggest that you follow Uncle Sam's example; investigate the performance of Aqulux Heaters. Large volume, heavy-duty models with capacities to 540 g.p.h. are available for orders that are approved by W.P.B. We will gladly send complete data. S. T. Johnson Co., 940 Arlington Ave., Oakland, Calif. and 401 No. Broad St., Philadelphia, Pa.

S. T. JOHNSON CO.

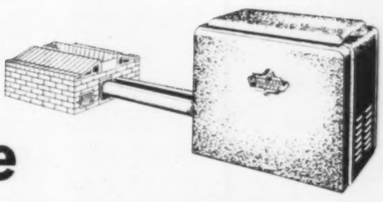
40 years of engineering and building fine Oil Burning Equipment

Need a Stoker for that Conversion Job?

LINK-BELT
AUTOMATIC COAL STOKERS



INDUSTRIAL and COMMERCIAL



are NOW Available for Conversion from Oil or Gas to COAL

in a full range of sizes up to 300 B.H.P. for bituminous coal

Return This Coupon

for copy of new Link-Belt Conversion Book No. 1760.

LINK-BELT COMPANY
2410 W. 18th St., Chicago 8, Ill., or 420 Lexington Ave., New York 17, N. Y.
Send copy of new Link-Belt Conversion Book No. 1970.
Name.. Firm..............................
Address ....

Mortite UTILITY TAPE

HUNDREDS OF USES

★

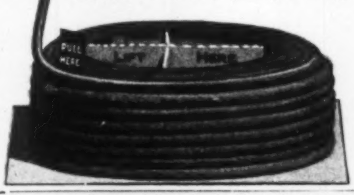
INSULATES • WEATHERSTRIPS
PLUGS UP CRACKS • MAKES PACKING
OR GASKETS • CAULKS CASEMENTS
GLAZES WINDOWS

This new pliable plastic does not crack, chip, dry out or shrink. Easy-to-handle, unrolls like ribbon and is ready for use, inside or outside. Can be painted.

SIMPLE TO APPLY

Mortite adheres to any clean, dry surface. No tacking or tools needed, just press into place and it stays put.

About 80 ft. to a box. Order through your supply house or $1.25 postpaid. ($1.40 west of Rockies.)



Circular Free

J. W. MORTELL CO.
512 BURCH ST.
KANKAKEE, ILLINOIS

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

NoDrip A SURE CURE

• This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition surfaces. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance. A gallon covers about 30 feet of ½" pipe. Dries in 24 hours. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House.

FREE NoDrip Circular about Condensation Drip and its Prevention.

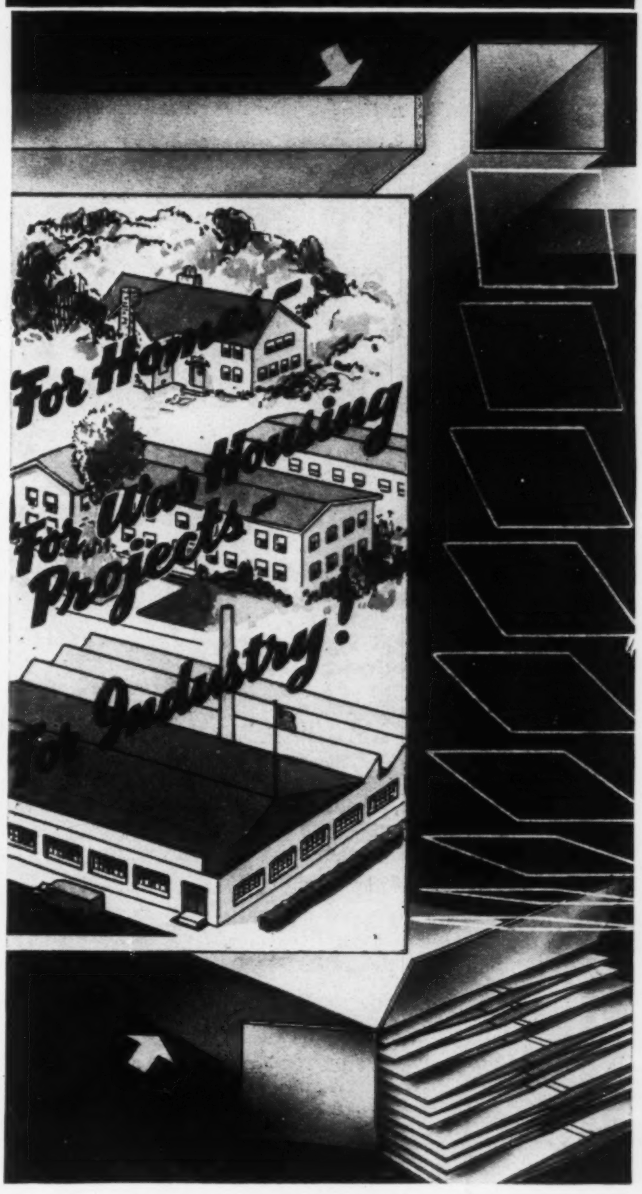
APPLY WITH BRUSH, TROWEL OR SPRAY

J. W. MORTELL CO.

Technical Coatings Since 1895

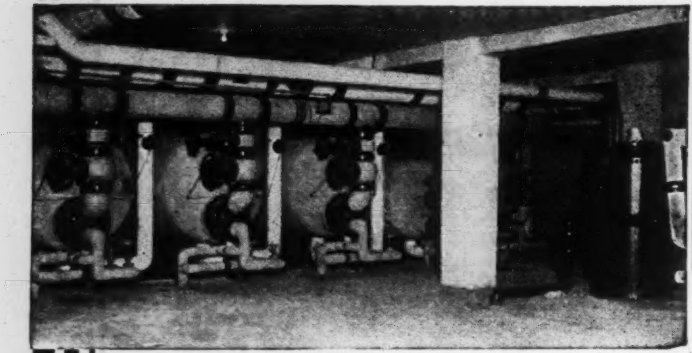
512 BURCH ST. KANKAKEE, ILL.

7 DEFINITE ADVANTAGES in SAL-MO SUPPLY DUCT for Warm Air Heating, Ventilating and Air Conditioning Systems



1. Each SAL-MO SUPPLY DUCT carries the Underwriters' "INSPECTED" label for Heating, Safety and Permanence.
2. The unique folding feature of this DUCT saves space in cars, storage and transferring to jobs.
3. SAL-MO SUPPLY DUCT embodies built-in insulation, insuring years of fuel saving.
4. Superior lightness (less than 8 oz. per square ft.) combined with superior strength (Mullens Test over 400 lbs. per square inch) assures ease in handling and structural stability.
5. Fabricated entirely with insoluble adhesives, weather and high humidiy cannot affect it.
6. Manufactured in 26 standard sizes (areas from 26 square inches to 448 square inches—in 4-foot time-saving lengths) allowing for all types of installations.
7. Also furnished in flat sheets containing from 11 to 24 square feet, which can be easily rolled or scored on the job.

SALL MOUNTAIN COMPANY
176 W. Adams Street, Dept. F Chicago 3, Ill.



WHITLOCK
Water Heaters

✓ **"STANDARD" with Architects, Engineers and Contractors for many years.**

WHITLOCK Storage Heaters, Converters, Fuel Oil Preheaters and other heat exchangers give long, satisfactory service—the kind of service you want your clients and customers to get. That's why it's standard practice with hundreds of leading architects, engineers and contractors to specify and install WHITLOCK Heaters. Our engineers will be pleased to recommend the most efficient design and type of WHITLOCK Heater or Heat Exchanger to suit your particular requirements.

✓ **Available upon WPB Authorization**

As you are probably aware, delays in purchasing heat exchangers are avoided by careful compliance with WPB regulations. The requirements for WPB approval are somewhat complicated but all WHITLOCK Engineers are familiar with the subject and will be pleased to advise you regarding the necessary procedure.

The **WHITLOCK**
MANUFACTURING COMPANY

44 South St., Elmwood,
Hartford 1, Conn.

District Offices in New York, Boston,
Chicago, Philadelphia, Detroit, Richmond

Text of Newly Amended Refrigerant Order M-28

Part 970—Chlorinated Hydrocarbon Refrigerants Conservation Order M-28, as amended August 7, 1943

The fulfillment of requirements for the defense of the United States has created a shortage in the supply of chlorinated hydrocarbon refrigerants for defense, for private account and for export; and the following order is deemed necessary and appropriate in the public interest and to promote the national defense.

Section 970.1—Conservation Order M-28.

(a) *Definitions.* For the purpose of this order:

(1) "Chlorinated hydrocarbon refrigerants" means trichloromonofluoromethane, dichlorodifluoromethane, dichloromonofluoromethane, trichlorotrifluoroethane, and dichlorotetrafluoroethane

(2) "Person" means any individual, partnership, association, business trust, corporation, governmental corporation or agency or any organized group of persons whether incorporated or not.

(3) "Producer" means any person engaged in the production of chlorinated hydrocarbon refrigerants.

(4) "Contract agent" means any person engaged in the business of accepting orders for chlorinated hydrocarbon refrigerants on behalf of and as agent for a producer.

(5) "Supplier" means any person engaged in the business of distributing chlorinated hydrocarbon refrigerants to persons using the same for installation in a refrigerating or air conditioning "system". The term shall include an equipment manufacturer to the extent that he engages in the sale of such refrigerants to distributors or dealers handling "systems". "System" means any "system" as defined in General Limitation Order L-38

(6) "Equipment manufacturer" means any person who uses chlorinated hydrocarbon refrigerants for charging new refrigerating or air conditioning systems manufactured by him.

(7) "Insecticide manufacturer" means any person who uses chlorinated hydrocarbon refrigerants in the production of insecticides.

(8) "User" means any person who installs chlorinated hydrocarbon refrigerants in a refrigerating or air conditioning system, other than an equipment manufacturer.

(9) "Comfort cooling system" means any air conditioning system of a type described on List A, made a part of this order.

(b) *Classification of uses of chlorinated hydrocarbon refrigerants.* The uses of chlorinated hydrocarbon refrigerants are hereby classified as follows:

Class I

Army, for use in new or existing refrigeration and air conditioning systems.

Class II

Navy, for use in new or existing refrigeration and air conditioning systems.

Class III

(a) Maritime Commission or War Shipping Administration, for charging new refrigeration or air conditioning systems at factories of equipment manufacturers.

(b) Maritime Commission or War Shipping Administration, for charging new refrigeration or air conditioning systems in the field.

(c) Maritime Commission or War Shipping Administration, for maintenance and repair of systems already installed.

Class IV

(a) For maintenance of industrial, wholesale, retail, and household refrigeration systems used for the processing, storage, and dispensing of food and food products, but excluding systems referred to on List A or List B.

(b) For maintenance of industrial refrigeration and air conditioning systems used for processing of products other than food.

(c) For maintenance of all other refrigeration and air conditioning systems not included under (a) or (b) above, and not on List A or List B. This class includes sealed railroad cars.

Class V

Charging new refrigeration and air conditioning systems in the field except those systems owned and operated by the Army, Navy, Maritime Commission and War Shipping Administration, and excluding comfort cooling systems.

Class VI

Charging new equipment by an equipment manufacturer, exclusive of comfort cooling systems. This class does not include charging systems for Army, Navy, Maritime Commission and War Shipping Administration.

Class VII

Maintenance and repair of comfort cooling systems and maintenance and repair of refrigeration equipment used solely for storing or dispensing carbonated or malt beverages. This class does not include systems owned and operated by the Army, Navy, Maritime Commission or War Shipping Administration.

Class VIII

Inventory—Surplus refrigerants in excess of one month's anticipated requirements.

(c) *Certification of orders by users, and deliveries thereunder.*

(1) *Orders must be certified.* On and after July 15, 1943, no user shall place an order with a supplier or any other person, and no supplier or other person shall accept such an order, for any chlorinated hydrocarbon refrigerants unless such order (or vendor's delivery receipt) is accompanied by a certificate endorsed thereon, or attached to

it, showing the uses for which the refrigerants are required, and in substantially the following form:

"The undersigned purchaser hereby certifies to the seller and to the War Production Board that he has no empty or surplus cylinders, and that, to the best of his knowledge, information and belief, the quantities of chlorinated hydrocarbon refrigerants covered by this order will be required during the next thirty days for use for the following classified purposes, as described in Conservation Order M-28:

Classification	*Quantity Required*
(Here list classifications included in the purchase order)	(Here list quantity, in pounds, ordered for each classification)"

Such certificate shall in every case be signed by the user or his authorized official, either manually or as provided in Priorities Regulation No. 7. It shall constitute a representation to the War Production Board, as well as to the supplier, that the facts stated therein are true No supplier shall make any delivery under such an order if he knows, or has reason to believe, that such certificate contains any false, inaccurate or incomplete statement. He may rely thereon if he does not know or have any reason to believe that a certificate is inaccurate, incomplete or false.

On and after July 15, 1943, no supplier shall deliver any chlorinated hydrocarbon refrigerants except pursuant to an order accompanied by such a certificate as provided for above.

(2) *Deliveries to be subject to restriction.* If and whenever any use shall be prohibited, as provided in (g) below, no user shall install or use any chlorinated hydrocarbon refrigerants for such a use, regardless of the purpose for which it was acquired.

(d) *Certification of orders by suppliers; records; deliveries by suppliers.*

(1) *Orders must be certified.* On or before July 15, 1943, and on or before the 10th day of each calendar month thereafter, each supplier who wishes to secure delivery of chlorinated hydrocarbon refrigerants through any contract agent during the next calendar month, shall place his order for such refrigerants with the contract agent. No supplier shall place such an order with a contract agent, and no contract agent shall accept such an order unless it is accompanied by a certificate endorsed thereon or attached thereto showing the uses for which the refrigerants are acquired, and the supplier's deliveries during the preceding month, in substantially the following form (except that deliveries made prior to July 15, 1943, may be estimated).

"The undersigned purchaser hereby certifies to the seller and to the War Production Board that to the best of his knowledge, information and belief, the quantities of chlorinated hydrocarbon refrigerants covered by this order will be required during the next calendar month for deliveries by him for the following classified purposes, as described in Conservation Order M-28; and that he made deliveries during the preceding month of .... as shown below:

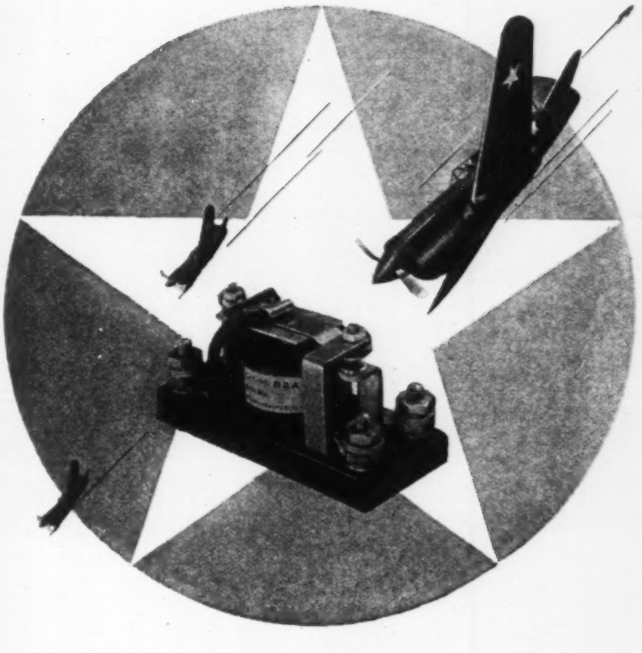
Classification	*Quantities Required*	*Deliveries in Preceding Month*
(Here list classifications included in purchase order)	(Here list quantity, in pounds, ordered for each classification)	(Here show quantities delivered in preceding month for each classification)"

Such certificate shall in every case be signed by the supplier or his authorized official, either manually or as provided in Priorities Regulation No. 7. It shall constitute a representation to the War Production Board as well as to the contract agent, that the facts stated therein are true. No contract agent shall approve or request any such delivery if he knows, or has reason to believe, that such certificate contains any false, inaccurate or incomplete statement. He may rely thereon if he does not know or have any reason to believe that a certificate is inaccurate, incomplete or false.

On and after August 1, 1943, no contract agent shall approve or request delivery of any chlorinated hydrocarbon refrigerants to any supplier except pursuant to an order placed, and accompanied by such a certificate, as provided for above.

(2) *Records must be kept.* Each supplier shall keep records showing the quantities of chlorinated hydrocarbon refrigerants delivered by him during each month for the various uses as classified in paragraph (b) above and the quantities of such refrigerants allocated to him each month for deliveries in each of such classifications.

(3) *Deliveries by suppliers after August 7, 1943, for uses in (b) and (c) of Class IV.* Chlorinated hydrocarbon refrigerants will not be allocated for the uses described in parts (b) and (c) of Class IV by regular monthly deliveries to suppliers. In the event a system operated for any of such uses becomes inoperative for lack of refrigerant, a separate application for refrigerants must be made by the owner of the system, directly to the War Production Board, General Industrial Equipment Division, by letter, telegram, or other communication, stating (i) whether the system is used for air conditioning or refrigeration, (ii) its size or capacity by horsepower or tons of refrigeration, (iii) the minimum operating charge necessary to restore the system to operation, (iv) why conversion to another type of refrigerant is not practicable, (v) the functional use of the system in the plant, and (vi) the end product being processed by its use. If the application is granted, the Board will issue a specific direction to the producer authorizing and directing delivery of a specified quantity to be made to the owner of the particular system for the use specified. No user, supplier, or other person shall deliver any chlorinated hydrocarbon refrigerant to the owner of such a system unless and until the Board has specifically directed such delivery to be made. This paragraph (d) (3) shall be followed, as long as it remains in effect, notwithstanding



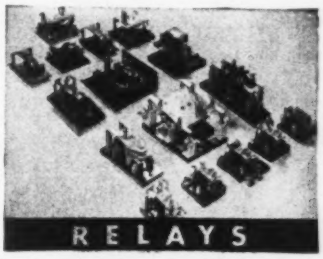
BUILT FOR THE AIR SERVICE

When Ward Leonard developed their B-2A Relay to meet the Army Air Corps tests for vibration and acceleration, they went further than required. They incorporated features in it not found in any other relay.

The layer-wound coils are thoroughly impregnated by a vacuum process that assures better insulation under humid conditions. The tail spring and contact gap are readily adjustable, thus enabling perfect adaptation to the required circuit. The anchorage for the terminal screws molded in the base assures rigidity of the entire relay under vibration.

Yes, this relay is used on aircraft, but the very features that make it desirable for airplane use make it equally desirable for any purpose when a rugged, positive, crisp-acting relay is required. Send for bulletin.

W. L. B-2A Relay is rated 25 A. at 24 V. single pole, single throw, normally open contacts.



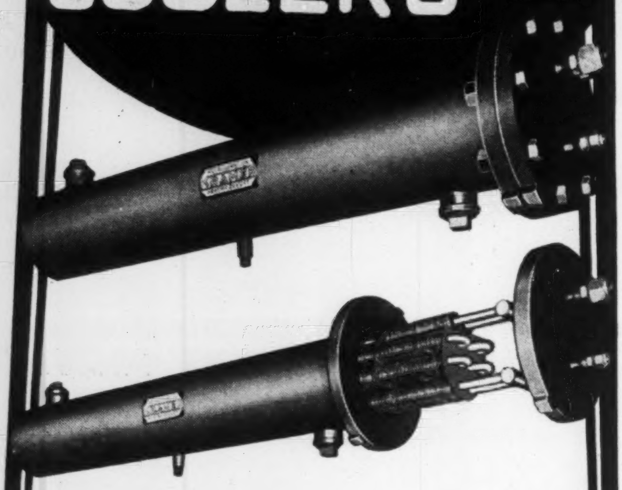
ARMY E NAVY
ARMY E NAVY

WARD LEONARD
RELAYS • RESISTORS • RHEOSTATS
Electric control WL devices since 1892.

WARD LEONARD ELECTRIC COMPANY
31 SOUTH STREET, MOUNT VERNON, N. Y.

KRAMER

COOLANT COOLERS



THE design of the Kramer Coolant Coolers is based on actual tests made in the KRAMER laboratory.

Considerable study was made to obtain the proper ratio of primary and secondary surfaces in the cooling coil.

These units are designed for use with water, brine, or direct expansion refrigerant.

●

For full information, send for our Bulletin R-443 and Form R-243.

KRAMER-TRENTON CO.

Trenton, N. J.

COILS:
Bare Tube • Finned • Plate
CONDENSERS:
Air Cooled • Evaporative • Water Cooled
UNIT COOLERS:
Coolmaster • Freezing Oven (Electric Defrost)
Freezing Shower (Water Defrost)
AIR CONDITIONING UNITS • BLAST COOLING UNITS
BLAST HEATING COILS • COMFORT COOLERS • UNIT HEATERS
OIL COOLERS. • COMBUSTION ENGINE RADIATORS
KRAMER SYSTEM (Balance Loader)

any other provisions of this order. However, suppliers will continue to place their orders for refrigerants, for uses described in Class IV in parts (a), (b) and (c) (listing (a), (b) and (c) separately), in accordance with paragraph (d).

(4) *Deliveries by suppliers during August, 1943, and subsequent months.*

(i) During the month of August, 1943, and each succeeding calendar month, no supplier shall deliver for any use a greater quantity of refrigerants than is allocated to him during such month for that use, except as provided in (ii) below. A supplier shall rely upon the notification given him, by the contract agent with whom his order was placed, as to the quantities allocated the supplier for each of such uses during each calendar month, unless he knows or has reason to believe that such notification is incorrect, incomplete or false.

(ii) If a supplier has exhausted the quantity allocated him for classifications I, II, III, or IV during any calendar month, he may use his supply in classification VIII for the classification exhausted. If classifications IV and VIII become exhausted, he may then draw upon the supply allocated for classifications V or VI.

(iii) No supplier shall deliver during any month any such refrigerants allocated to him for delivery to or for use by the Army, Navy, Maritime Commission or War Shipping Administration (Classes I, II and III) for use by any other person during that month; and no supplier shall deliver to or for use by any of such agencies any refrigerants which were allocated to him for civilian uses (Classes IV, V and VI) during that month.

(iv) Any chlorinated hydrocarbon refrigerants allocated for classifications I through VII during any month and not delivered by the supplier during the month shall be transferred by him to classification VIII (Inventory), at the end of such month. If notice of his allocations for the following month has not been received by the first day of the month, the amount transferred to Class VIII (Inventory) from any classification may continue to be used for such classification; provided that the amount so used is restored to Class VIII, by deduction from the new allocation for that classification, as soon as notice of the new allocation for such month is received.

(e) *Certification of orders by contract agents, equipment manufacturers, and insecticide manufacturers.*

(1) *By contract agents.* On or before the 20th day of each calendar month, commencing with the month of July, 1943, each contract agent who transmits orders for chlorinated hydrocarbon refrigerants from suppliers to a producer, for delivery during the next calendar month, shall place a written request for shipments, covering all of such orders, with the producer. No contract agent shall place such orders with a producer, and no producer shall accept such orders unless accompanied by the request with a certificate endorsed thereon or attached thereto, showing the uses for which the refrigerants are ordered, and deliveries made during the preceding month by suppliers placing orders through the agent, and in substantially the following form (except that deliveries prior to July 15, 1943, may be estimated):

"The undersigned contract agent hereby certifies to the producer and to the War Production Board that he has received orders for shipment of the quantities of chlorinated hydrocarbon refrigerants covered by this request for shipments, for the following classified purposes as described in Conservation Order M-28: and that deliveries during the preceding month of ....were made as shown below:

Classification (Here list classifications included in all purchase orders)	*Quantities Requested* (Here list aggregate quantity in pounds ordered for each classification by suppliers)	*Deliveries in Preceding Month* (Here show aggregate quantities delivered in preceding month for each classification, as shown by suppliers' certificates)"

Such certificate shall in every case be signed by the contract agent or his authorized official, either manually or as provided in Priorities Regulation No. 7. It shall constitute a representation to the War Production Board as well as to the producer, that the facts stated therein are true. No producer shall make any such shipment or delivery if he knows, or has reason to believe, that such certificate contains any false, inaccurate or incomplete statement. He may rely thereon if he does not know or have any reason to believe that a certificate is inaccurate, incomplete or false.

(2) *By equipment and insecticide manufacturers.* On or before the 20th day of each calendar month, commencing with the month of July, 1943, each equipment manufacturer or insecticide manufacturer who wishes to secure delivery of chlorinated hydrocarbon refrigerants from a producer during the next calendar month shall place his order for such refrigerants with the producer. No such manufacturer shall place such an order with a producer, and no producer shall accept such an order unless it is accompanied by a certificate endorsed thereon or attached thereto, showing the uses for which the refrigerants are acquired, and the quantities used during the preceding month, in substantially the following form:

"The undersigned purchaser hereby certifies to the seller and to the War Production Board, that to the best of his knowledge, information and belief, the quantities of chlorinated hydrocarbon refrigerants covered by this order will be required by him during the month of .... for the following purposes, according to the classifications described in Conservation Order M-28 (or for the production of insecticide for the Army or for the Navy); and that he used such refrigerants during the preceding month of .... as shown below:

Proposed Use	*Quantities Required*	*Used in Preceding Month*
(Here show whether proposed use is for insecticide, or for classifications under M-28, or for each)	(Here list quantity, in pounds, ordered for each use, or classification)	(Here show quantities used in preceding month for each)"

Such certificate shall in every case be signed by the equipment or insecticide manufacturer or his authorized official, either manually or as provided in Priorities Regulation No. 7. It shall constitute a representation to the War Production Board, as well as the seller, that the facts stated therein are true. No producer shall make any delivery under such an order if he knows, or has reason to believe, that such certificate contains any false, inaccurate or incomplete statement. He may rely thereon if he does not know or have any reason to believe that a certificate is inaccurate, incomplete or false. On and after August 1, 1943, no producer shall deliver any chlorinated hydrocarbon refrigerants to any equipment manufacturer or insecticide manufacturer except pursuant to an order placed, and accompanied by such a certificate, as provided for above.

(f) *Shipments by producers.*

(1) *Statement of requested shipments.* On or before the 25th day of each calendar month, commencing with the month of July, 1943, each producer shall file with the War Production Board a statement showing: the orders for chlorinated hydrocarbon refrigerants which have been transmitted to him by contract agents, or which have been placed with him by equipment and insecticide manufacturers, for delivery during the next calendar month, and the uses for which the refrigerants are ordered, as indicated by the certificates accompanying the orders; the quantity of such refrigerants which will be available for delivery by him, during such month; and his deliveries of such refrigerants to the suppliers and equipment and insecticide manufacturers, during the preceding calendar month (except that deliveries to suppliers prior to August 1, 1943, need not be shown by classifications).

(2) *Deliveries by producers.* On and after July 10, 1943, no producer shall deliver any chlorinated hydrocarbon refrigerants to any person, or for any use, except in accordance with specific directions from the War Production Board. Such directions will be issued primarily to insure the meeting of defense requirements, and of the more essential needs if and whenever all cannot be met. Such directions may specify the aggregate quantities of such refrigerants which shall be delivered by the producer during any calendar month (or other period) for any of the classifications of uses established by this order or for other requirements (including Lend-Lease, and the production of insecticide, separately, for Army and Navy use), or the proration of the available supply among all or any part of the various classifications and other requirements, or establish a reserve or emergency stock to be held by the producer. Such directions may also direct the producer to make such adjustments in his deliveries as may appear reasonable and appropriate to equalize the inventories held by suppliers, so as to more nearly assure all suppliers of a minimum working inventory whenever practicable. Directions issued under this order to a producer and directing deliveries to be made by him for specified uses or in specified quantities shall be deemed allocations of the refrigerants for the purposes specified and, subject to the provisions of this order, no producer, supplier, equipment manufacturer or insecticide manufacturer shall make or receive delivery for any other purpose.

(g) *Prohibited uses (List B), emergency cases.*

(1) No user, supplier, contract agent, or producer shall deliver or cause to be delivered to the owner of any system, any chlorinated hydrocarbon refrigerants for use in, or for resale for use in any system of the types described on List B, made a part of this order. Such list may be changed from time to time (from month to month, or otherwise) by amendments to this order, as the War Production Board may consider necessary to assure sufficient supplies of such refrigerants in all areas and for the uses which are deemed most essential to the national defense.

(2) An authorization for an exemption from the terms of paragraph (g)(1) above may be allowed by the War Production Board when an air conditioning system must be operated (i) to avoid intolerable conditions in sealed or substantially air tight rooms or enclosures used for essential purposes, or (ii) to protect the life or health of a person under care of a licensed physician. An exemption from the requirement of paragraph (d) that a supplier's order must be placed by the 10th of the month preceding that in which delivery is required, may be allowed when the supplier demonstrates that, due to causes beyond his control, it will be impossible for a delivery in classifications I, II, III or IV to be met by him or any other supplier or user unless an exemption is allowed. Application for such an authorization may be made by or on behalf of the person affected by such restriction, by letter or telegram or other communication addressed to the General Industrial Equipment Division, War Production Board, stating facts sufficient to enable the Board to determine the necessity for such authorization. If granted, the authorization may be by letter or telegram, and shall be transmitted by the applicant to the person who will supply such refrigerants, and shall be deemed an authorization to any user or supplier to furnish or install the minimum operating charge necessary to maintain such system in adequate operation.

Got a Control Valve Problem?
CALL ON K & M

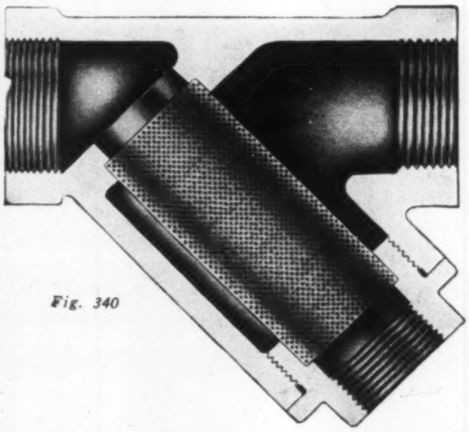
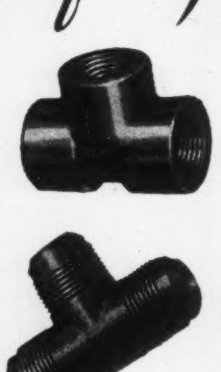


Fig. 340

War has curtailed our civilian manufacturing—and multiplied the difficulties of your job. But don't let it get you down. If you have a problem involving pressure or fluid control—an installation, operating or maintenance problem—we can save you days of work and worry. Call on our new VALVE PROBLEM CLINIC. All the know-how of 65 years of specialization is yours for the asking . . . no charge, no obligation, no red tape. Whether or not you are using K & M equipment . . . we invite you to *call on K & M.*

K & M SIMPLES PRESSURE REDUCING VALVE, particularly applicable in reducing water main pressure to protect fixtures in residential or industrial service . . . or for other water, air, gas or cool oil service where space limitation is a factor and initial pressure is 150 lbs. or less. Sizes ½" to 2"—with traditional K & M efficient design and rugged construction.

KM KIELEY MUELLER ESTABLISHED 1879
Kieley & Mueller
ENGINEERED PRESSURE & FLUID CONTROL SPECIALTIES
NORTH BERGEN, NEW JERSEY
Representatives in all Principal Cities



Yes —
Saran worked perfectly

To those who have been skeptics, we present this portrait of a gentleman pleased with Saran's performance. However, the best evidence of Saran's adaptability to many jobs is a list of some sixty-five types of successful installations just compiled. This list is contained in our new tube folder P-9 which we urge you to send for today.

Special note: At present, Saran is under allocation for certain essential uses. We will be pleased to advise whether or not you would be entitled to its use.

***SARAN**
TUBE-PIPE-FITTINGS
HODGMAN RUBBER CO.
FRAMINGHAM, MASS.

New York
261 Fifth Ave.

Chicago
412 So. Wells

San Francisco
121 Second

**Pat. No. 2160931*

(h) *Notification of customers.* Any producer, contract agent, supplier, or person who is prohibited from or restricted in making deliveries of any chlorinated hydrocarbon refrigerants by the provisions of this order, and any producer who is prohibited from or restricted in making any such deliveries by any directions issued hereunder and received by him from the War Production Board, shall as soon as practicable notify each of his regular customers of the requirements of this order or of such directions; but the failure to give such notice shall not excuse any customer from the obligation of complying with any requirement of this order, or of any such directions applicable to such customer and of which he has notice.

(i) *Effect of preference ratings.* The provisions of this order shall be followed by every producer, contract agent, supplier, user, equipment manufacturer, insecticide manufacturer, and any other person buying, selling or delivering chlorinated hydrocarbon refrigerants, without any regard to any preference ratings which have been assigned or which may hereafter be assigned to particular contracts or orders.

(j) *Miscellaneous provisions.*

(1) *Applicability of regulations.* This order and all transactions affected thereby are subject to all applicable regulations of the War Production Board, as issued and amended from time to time.

(2) *Monthly reports.* Each person (including a producer, contract agent, supplier, equipment manufacturer, insecticide manufacturer, user, or owner of refrigerating or air conditioning systems) who has in his possession on the 15th day of any calendar month in excess of 500 pounds of any type of chlorinated hydrocarbon refrigerants, and any person who sold in excess of 2000 pounds of any type of such refrigerants during the preceding calendar month, shall file with the War Production Board, on or before the 20th day of each month, commencing with the month of July, 1943, a report on Form WPB-3054 prepared in accordance with the instructions for such form.

(3) *Violations.* Any person who wilfully violates any provisions of this order, or who, in connection with this order, wilfully conceals a material fact or furnishes false information to any department or agency of the United States is guilty of a crime and upon conviction may be punished by fine or imprisonment. In addition, any such person may be prohibited from making or obtaining further deliveries of, or from processing or using materials under priority control, and may be deprived of priorities assistance.

(4) *Appeals.* Any appeal from the provisions of this order, or any direction thereunder, shall be made by filing a letter in triplicate, referring to the particular provision appealed from and stating fully the grounds of the appeal.

(5) *Communications.* All reports to be filed and other communications concerning this order should be addressed to: War Production Board, General Industrial Equipment Division, Washington, D. C., Ref: M-28.

Note: The reporting requirements of this regulation have been approved by the Bureau of the Budget in accordance with the Federal Reports Act of 1942.

Issued this 7th day of August, 1943.

WAR PRODUCTION BOARD
By: J. Joseph Whelan, Recording Secretary.

List A

"Comfort cooling system" means any system, of any size, operated or installed for the purpose of lowering the temperature and/or humidity of air in any building, room or other enclosure used as, or located in any of the following:

Amusement parks.
Animal hospitals.
Auditoriums.
Ballrooms, dancing studios, and dance halls.
Bank and loan associations.
Bars, cocktail lounges, and beer parlors.
Bowling alleys.
Concert halls.
Funeral parlors.
Golf clubs, country clubs, and athletic clubs.
Hotels and apartment houses.
Moving picture houses.
Night clubs.
Office buildings and offices, public or private.
Railway, street car and bus stations and terminals.
Residential buildings and dwellings of all kinds.
Restaurants, cafeterias, and other places selling meats, food or beverages.
Schools.
Service establishments, such as laundries, cleaners and dyers, tailor shops, barber shops, "beauty" parlors, automobile sales and service shops, and repair shops of all kinds.
Skating rinks.
Stores, selling any kind of products, material or merchandise at retail or wholesale (excluding manufacturing establishments).

The term "comfort cooling system" shall not include (i) any such system used to air condition a building, room or other enclosure used chiefly for purposes not listed above, or (ii) any system designed, necessary and used, in substantial part for the refrigeration and storage or processing of food, ice, or other materials or products requiring refrigeration, temperature control, or freedom from dust or other impurities, or (iii) such part of a system as may be necessary and used for the circulation of air, or necessary and used for raising the temperature of air during cold weather to a degree which is comfortable or tolerable for persons (comfort heating).

List B

Systems for Which Chlorinated Hydrocarbon Refrigerants Shall Not Be Delivered

Systems	*Effective Date*
Comfort cooling systems	June 5, 1943
Skating rink systems	June 5, 1943
Refrigeration systems solely for storing or dispensing carbonated or malt beverages	July 10, 1943

(Interpretation 1)

(a) *Reports of inventories.* The reporting requirement of paragraph (j) (2) of Order M-28 [§ 970.1] must be complied with regardless of whether the chlorinated hydrocarbon refrigerants are being held by the owner for his own use or for resale.

The paragraph requires every person (including the owner of a refrigerating or air conditioning system) who has in his possession on the 15th day of any calendar month (commencing with the month of July), more than 500 pounds of any type of chlorinated hydrocarbon refrigerants, or who sold more than 2,000 pounds of such a refrigerant during the preceding calendar month, to file a report on Form WPB-3054 with the War Production Board on or before the 20th day of the month.

Each "person," as defined in the order, must report the aggregate quantities in his possession (including stocks of less than 500 pounds located at various places) if the total is more than 500 pounds.

The report must include all amounts not actually being used in refrigerating or air conditioning systems. Thus the owner or operator of a system who has more than 500 pounds in his possession must report his entire supply except for the minimum operating charge actually installed in his system. Any additional amount which he may have must be reported, whether kept in cylinders, a storage receiver or other form of container. However, if a minimum operating charge is being temporarily held in a container while the system in which it had been installed is being repaired, it should not be reported.

Any equipment manufacturer who has more than 500 pounds in his possession on the 15th day of any calendar month must report his entire supply except what has been actually installed as an operating or holding charge in accordance with his regular manufacturing practice.

(b) *Charging of equipment manufacturers.* Paragraph (g) provides that no user, supplier, contract agent, or producer shall deliver, or cause to be delivered, to the owner of any system any chlorinated hydrocarbon refrigerants for use in, or for resale for use in any system of the types described on List B.

This restriction is intended to prevent charging any system of the types included on List B with chlorinated hydrocarbon refrigerants except for a person who was operating a system and had the necessary refrigerants in his possession on the effective date specified in List B. Therefore, a manufacturer may not charge any such system with chlorinated hydrocarbon refrigerants before delivery, and he may not deliver the refrigerant separately to be used in charging the system. However, he is not restricted from delivering systems which had already been charged with such a refrigerant on the effective date specified on List B.

(Issued August 9, 1943.)

Useful Information

Plan Now for Future Public Works

In a pamphlet entitled Plan Now for Future Public Works, the construction and civic development department of the Chamber of Commerce of the United States, Washington, D. C., points out that construction is one major industry which will need no time for conversion to post-war conditions, as the operation of a construction project and the materials used are similar in both military and in civil work. Thus the existence of a work pile of private and public construction projects in the blueprint and specification stage may well constitute the means of keeping economic balance in a community during the period when many other industries in that community are in the process of conversion. While recent surveys indicate that some 40 states, at least 100 cities with populations over 50,000, and a few counties are engaged in some sort of public works planning, much of this, on careful examination, turns out to be simply a listing of desired improvements. Actual physical planning—essentially a process of design—is, however, needed.

GIVE
✚
RED CROSS WAR FUND

Public construction projects fall into two categories, the first being the immediate needs resulting from the meager maintenance of war years and almost complete stoppage of the normal additions and betterments to our public facili-

Burnham

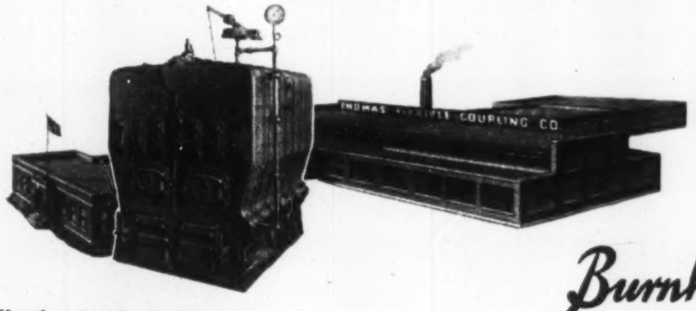
50" Boiler Picked For Coupling Plant

In the Fall of 1942 the THOMAS FLEXIBLE COUPLING CO., Warren, Pa., installed a new heating system in their modern daylight plant which included a Burnham 50" Twin-Section Boiler.

***They wrote us on June 16, 1943* (unsolicited)**

"With your Burnham Boiler and 11 Unit Heaters, we believe we have one of the finest Heating Systems that can be designed. Our oil consumption for the past season—Oct. 14, 1942 to June 15, 1943—was only 14,659 gallons, working 24 hours a day, 6 and 7 days per week.

We have had very satisfactory heat from our installation in spite of the severe winter and continuous temperatures of 20 degrees below Zero."


THOMAS FLEXIBLE COUPLING CO.

Complying with the oil conservation program, this installation is now being converted to stoker firing, but with the husky 50" Burnham, equally good results will be obtained.

Heating Load—6104 Sq. Ft.
Heating Contr.—Warren Plbg. & Htg. Co.
Oil Burner—Williams Oil-O-Matic
Boiler—Burnham 0-5008-S

Burnham Boiler Corporation
Irvington, New York, Dep't P
Zanesville, Ohio, Dep't P

ties. A second category includes the long range development programs provided for street and highway systems to eliminate traffic congestion and the rebuilding of blighted or rundown areas. The committee feels that at the moment attention should be directed upon the kind of public works included in the first category.

One problem involved in such planning is that of antiquated building codes. In the interest of more efficient and more economic construction, those sections of building codes which do not permit designers to take advantage of approved modern methods should be revised and made effective immediately so that construction being planned now for postwar erection need not be unduly penalized.

Conserve On Electricity Use

Owners and operators of air conditioning systems have been asked by the War Production Board to adopt more moderate margins of reduction in temperature and relative humidity, as part of WPB's energy conservation program which is being inaugurated this month.

Science of Mechanics

The Science of Mechanics, by Ernst Mach, formerly professor of the history and theory of inductive reasoning at the University of Vienna, is the fifth English edition of a book first published in German in 1883. Surely a book on mechanics which can survive for such a long period must have something to recommend it.

As its cover states, this book is "a critical and historical account" of the development of the science of mechanics from the earliest days to the present. Although it is no ordinary text book on mechanics of the type used in colleges, those engineers who are interested in the phenomena underlying the subject of mechanics as they learned it in college will find this book fascinating browsing. There are no illustrative examples, no neatly arranged set of principles which follow one from the other. Instead, this book is devoted to a discussion—the philosophy, if you will—of the science of mechanics.

One word of warning is necessary. To enjoy this book, the engineer must be able to recall at least the elementary phases of the theoretical mechanics he learned at school.

There are 635 + xxxi pp., 5½ in. x 7¾ in. The publisher is the Open Court Publishing Co., La Salle, Ill.—W. G.

Suggested Minimum Firebox Dimensions and Base Heights

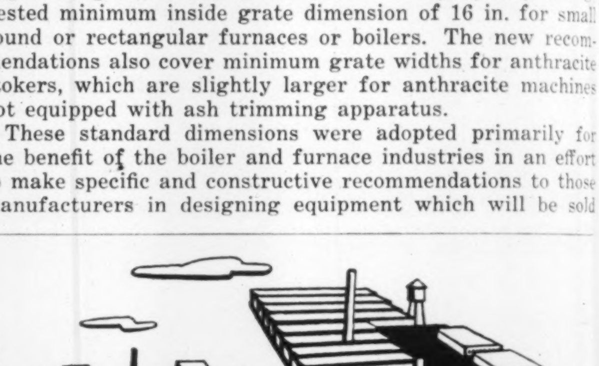
Another step in the stoker industry's program of standardization and establishment of recognized uniform methods of selection and application of equipment has been taken, J. M. McClintock, president of the Stoker Manufacturers' Association, 307 N. Michigan Ave., Chicago 1, Ill., announced last month, when the association's new publication on recommendations for dimensions covering boiler and furnace firebox and base heights for stoker firing was released.

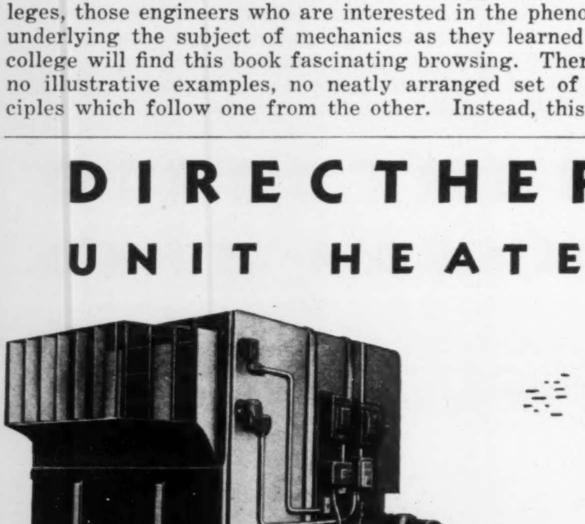
This new recommendation, which was approved and adopted officially at the recent annual meeting and war conference of the association, carries the stoker industry's unanimous endorsement of minimum recommended dimensions, which the industry believes will go a long way in assisting manufacturers of boilers and furnaces to design and construct their equipment for application to mechanical coal stoker firing.

Mr. McClintock added that these recommendations were adopted by the stoker industry's national organization after many months of study and conferences by the association's engineering and research committee. They specify a suggested minimum inside grate dimension of 16 in. for small round or rectangular furnaces or boilers. The new recommendations also cover minimum grate widths for anthracite stokers, which are slightly larger for anthracite machines not equipped with ash trimming apparatus.

These standard dimensions were adopted primarily for the benefit of the boiler and furnace industries in an effort to make specific and constructive recommendations to those manufacturers in designing equipment which will be sold

DIRECTHERM
UNIT HEATERS





HEAT LARGE AND SMALL PLANTS ECONOMICALLY

THEY require no costly pipe or duct work and can be installed in a few hours. The heat is evenly distributed and thrown out as far as 200 feet. About 80% of the fuel energy is utilized.

Directherm Unit Heaters do not require any maintenance. All you need is to set the automatic controls.

For coal, gas, and oil.
Made in 6 sizes (300,000—1,700,000 BTU).

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. • ST. LOUIS, MO.

and installed after the war. The new recommendations specifically note that, while the minimum firebox dimensions are recommended by the stoker industry for warm air furnaces and for boilers adapted to stokers having a capacity up to 1200 lb per hr of coal, under certain conditions smaller fireboxes will perform satisfactorily but that the dimensions suggested are preferred normal minimums.

Previous to the publication and release of the new SMA standard, meetings were held between the engineering and technical representatives of the stoker industry and the boiler and furnace industries. Further conferences are contemplated between the individual manufacturers of stokers and boilers and furnaces.

Simultaneously with the release of this new standard recommendation, Mr. McClintock also stated that the association is working on a new engineering manual, for publication some time in the fall, which will incorporate the various SMA standards and recommendations as well as other technical information designed to be of the greatest possible value to the users of stoker equipment, to consulting engineers, architects, heating contractors, installers of heating equipment, and to the distributors and dealers of stokers who have the everyday problem of matching and applying stokers to various types, kinds, sizes, and designs of boilers and furnaces burning various types and ranks of bituminous coals and anthracite.

Contamination by Successive Flow in Pipe Lines

A paper on Contamination by Successive Flow in Pipe Lines, by Frank C. Fowler and George Granger Brown of the University of Michigan, was presented at the New York, N. Y., meeting of the American Institute of Chemical Engineers, 50 E. 41st St., New York 17, N. Y., May 10-11, 1943, and was published in Vol. 39, No. 4, the August 25, 1943 Transactions of the institute.

Following is the authors' abstract of this paper:

In the transportation of different fluids in pipe lines, it

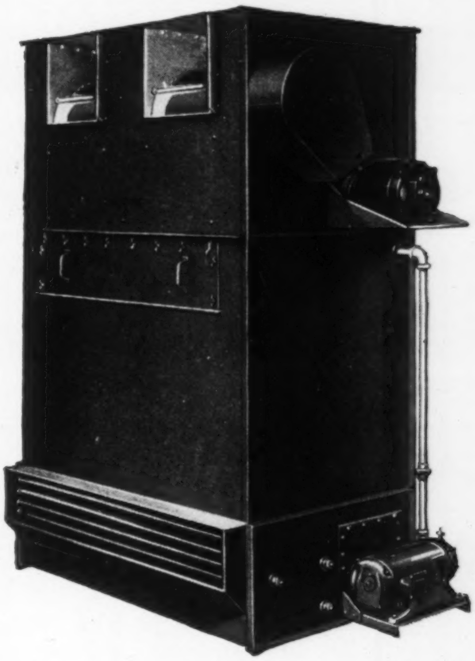
It's Easy TO SPOT DIRT CLOGGED FILTERS with a HAYS AIR-FILTER GAGE

0-1 .2 .3 .4 .5
HAYS

Of course you know that air-filters must be cleaned or replaced, but when? The Hays Air-Filter Gage tells you exactly when dirt clogged filters are obstructing air flow, impairing operating efficiency, increasing power costs. The gage is easy to install . . . nothing to get out of order. It has been recommended by engineers for nearly half a century. Write 990 Eighth Ave., Michigan City, Ind., for A-F G. Bulletin and prices.

The HAYS CORPORATION
SINCE 1901
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A

Backed by 25 years' experience in the industry



Evaporative Condensers

. . that supply greater efficiency

When Acme found a way to provide plenty of cooling surface without the use of fins—they hit upon a design that gives greater efficiency to evaporative condensers.

Acme Cooling Coils are copper tubing, steel tubing or steel pipe—*all prime surface.* Valuable space is conserved. They are especially designed for the job they do.

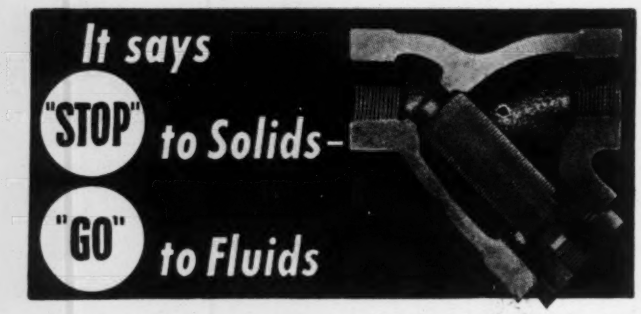
Greater air turbulence with resultant increased heat transfer is one advantage. Reduction of refrigerant pressure drop is another—and these specially designed coils are cleanable.

More cooling surface in less space.

All capacities for all jobs—write for catalog No. 27—and if our engineers can help you, just let us know.

ACME INDUSTRIES
Jackson, Mich.

ACME PRODUCTS ★★★



Here is a BETTER Strainer to "police your pipelines"

- **FIRST—*The Screen,* a high-grade, woven Monel wire basket that catches solids—lets condensate, oil or other fluids flow freely.**
- **SECOND—*Finish.* Cadmium plated inside and out for protection against corrosion.**
- **THIRD—*Easily Cleaned.* Blow-off bushing made for easy removal. Bushing and Screen come out together. Screen automatically aligns on reassembly.**

- **THOUSANDS IN SERVICE—Sold by over 100 Mill Supply Houses. 6 sizes from ½" to 2" for pressures up to 600 lb. Reasonably priced.**

See your supply house or write for Bulletin S-200.

YARNALL-WARING COMPANY
107 Mermaid Ave., PHILADELPHIA 18, PA.

YARWAY STRAINERS

is customary to pump one product immediately after the other. This leads to contamination of a portion of the material delivered from the far end of the pipe line. The paper reports experimental work in the laboratory under conditions where the contaminated portion may be determined with much greater precision than is possible in commercial lines. Fluids used consisted of water and salt solution of almost identical physical properties covering viscosities from about 0.8 to 1.5 centipoises, Reynolds numbers from less than 200 to 19,800, and length divided by diameter ratios from less than 200 to over 10,000.

In the laminar flow region the contaminated portion was found to be independent of Reynolds number as is indicated by a theoretical analysis.

In turbulent flow the contaminated portion may be computed by the following equation:

$$\log_{10} (\text{contaminated portion}) = \log_{10} (\text{pipe volume}) - 0.4 \log_{10} \frac{L}{D} + c$$

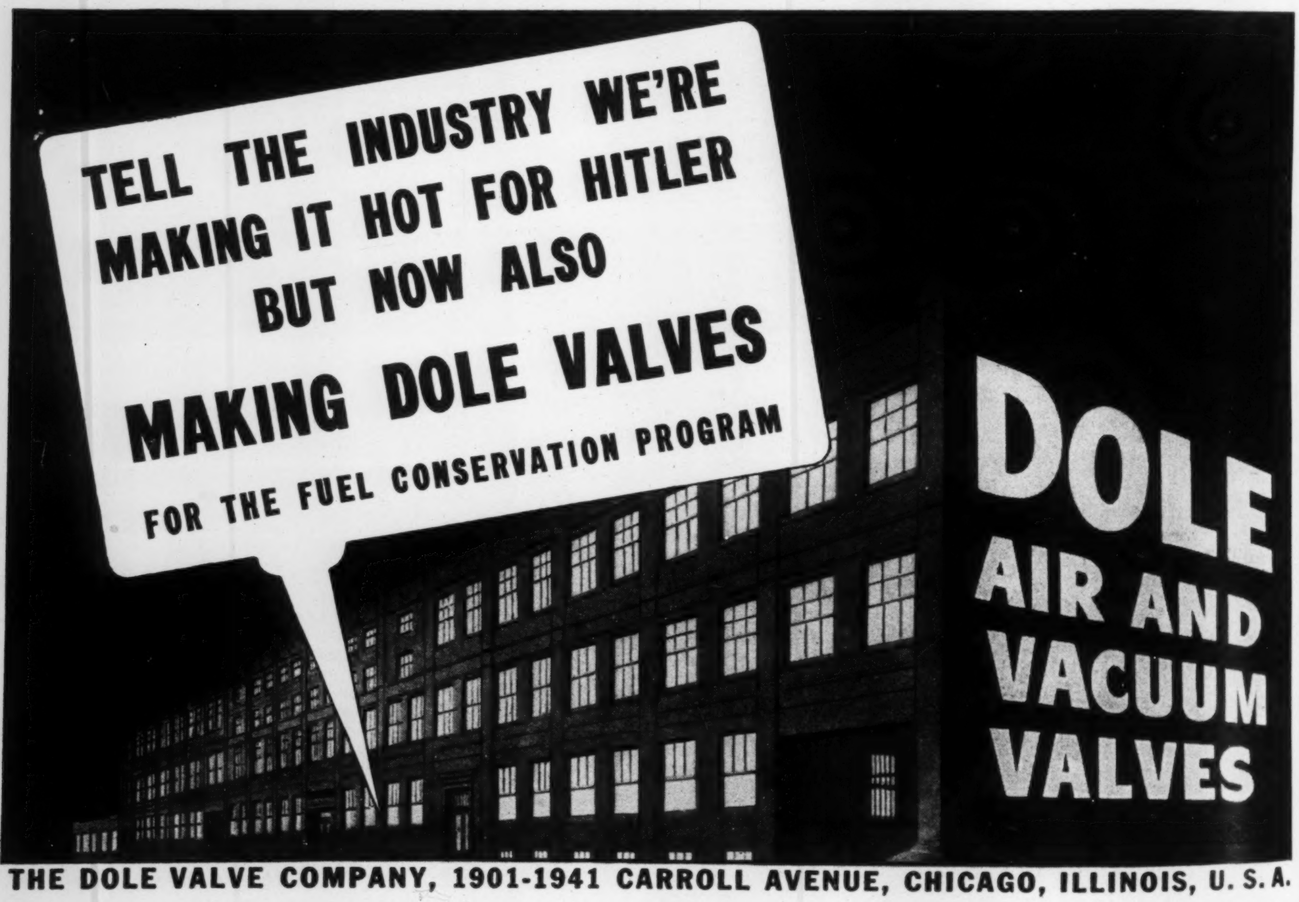
in which c is a function of the Reynolds number and the range in instantaneous composition defining the contaminated portion.

The above equation is applied to commercial pipe line data covering the transportation of oil products, using the average Reynolds number of the two products in the above equation. The commercial data cover viscosities varying from 0.51 to 7.4 centistokes, corresponding to Reynolds numbers from 27,000 to 610,000 (average Reynolds numbers from about 55,000 to 537,000) and length over diameter ratios from 437,000 to 1,765,000.

Pump Test Code Revised

The Hydraulic Institute, 90 West St., New York, N. Y., national trade association of pump manufacturers, has announced complete revision of the test code section of its standards.

This test code section, first published in 1936, contains


TELL THE INDUSTRY WE'RE MAKING IT HOT FOR HITLER BUT NOW ALSO MAKING DOLE VALVES FOR THE FUEL CONSERVATION PROGRAM
DOLE AIR AND VACUUM VALVES

THE DOLE VALVE COMPANY, 1901-1941 CARROLL AVENUE, CHICAGO, ILLINOIS, U. S. A.

specific recommendations for the testing of centrifugal and rotary pumps, both for acceptance tests in the field and in the plant of the pump manufacturer.

The code contains the limiting conditions for all methods of quantitative determination of capacity, head, and power input, whereby the accuracy for an acceptance test can be obtained.

Copies may be secured from the institute for 50c each.

Mathematics for the Sheet Metal Worker

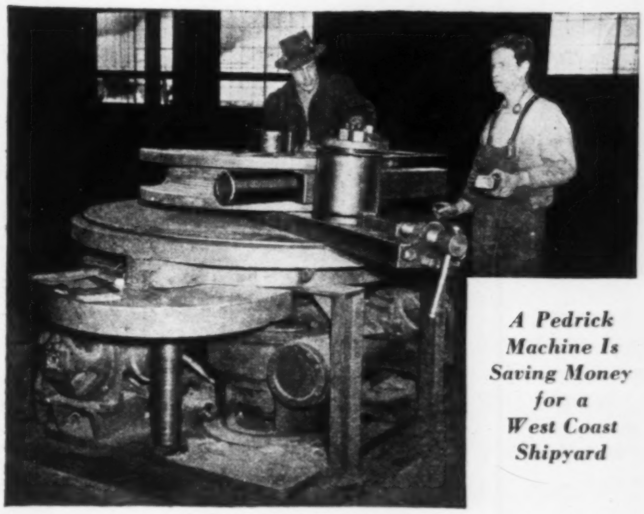
Mathematics for the Sheet Metal Worker in General, Aircraft, and Shipbuilding Shops—by Clayton E. Buell, instructor in a U. S. Navy yard apprentice school and the Edward Bok Vocational School—is offered for use in "on the job" training, more formalized classes, and home study. It is an effective means of acquiring a sound background in trade mathematics, and includes sample problems worked in detail to illustrate each principle.

There are chapters on common decimals and fractions; layout of angles, lines, and figures; use of formulas; measurement of lengths; bend allowance; measurement of areas and weights; measurement of surface area and volume; graphs; template development from tables; shop trigonometry; bend allowance by set back method; measurement of irregular areas and volumes; strength of materials; and ventilation of compartments. An appendix contains useful tables and formulas.

There are 198 + vii pp., 5¼ x 8 in. The publisher is the Pitman Publishing Co., 2 W. 45th St., New York, N. Y., and the price is $2.00.

Properties of Multiple Box Girder Plywood Panels

Report BMS99 of the series on building materials and structures, issued by the National Bureau of Standards, presents information on the structural and heat transfer properties of multiple box girder plywood panels for walls, floors, and roofs. At the request of the War Department,

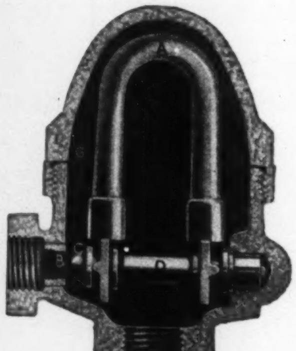

A Pedrick Machine Is Saving Money for a West Coast Shipyard

All Pedrick Pipe Benders Save You Money!

Write for literature showing how a piping job fabricated on Pedrick Machines is cheaper, stronger and quicker to install than other types of piping systems.

PEDRICK TOOL & MACHINE CO.
3640 N. Lawrence Street Philadelphia, Pa.

HAINES
Thermostatic Trap



Our operating member, the Bourdon Thermostatic Tube, is the strongest thermostat ever built into a Steam Trap. As the Bourdon Tube is used in gauges where accuracy is vital, it must improve the efficiency of a Trap. The operating member of Haines Traps either opens or closes the Valve Piece against the flow of steam which makes it an outboard Trap. Therefore, it does not become ineffective from sediment, sludge and scale but readily rids itself of all these foreign matters. There is no question whether a Haines Trap is functioning properly . . . it can be examined under pressure by simply removing the cover and all working parts are before you.

WILLIAM S. HAINES & COMPANY
460 North Twelfth Street Philadelphia, Pa.

It's not too early to order
ELECTRIC AIR HEATERS

Prompt deliveries are no longer possible. Order now and be prepared for chilly mornings. Put off firing the steam boiler until all-day heat is necessary.

CHROMALOX Electric AIR HEATERS

These units can be connected to any power line. No spot too remote. The ideal answer to early fall "on-and-off" heating needs. Also efficient for overtime heating of offices and drafting rooms. Thousands in use for heating watchmen's shelters. Portable or with brackets for permanent wall mounting. Thermostatic control if desired.

Above is the type HF heater, blower operated. Sizes, 1.5 to 4 kw. Other types to 40 kw., all built with the famous Chromalox electric heating units, in wide industrial use.

Write for the Chromalox Catalog of Electric Heat, on your business letterhead.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh 8, Pa.

SAVES MONEY...

BECAUSE MORE BULK PER POUND

No wonder master piping contractors and plant engineers have O.K.'d Rutland Pipe Joint Cement for 30 years. It seals joints tightly—last indefinitely—yet always leaves pipes easy to disjoin. Legal for use in all cities because no toxic ingredients. Remains soft in can. Does not stain hands or fixtures. Mail post card for free sample. Rutland Fire Clay Co., Dept. H-17, Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

RUTLAND
PASTE PIPE JOINT CEMENT
RUTLAND FIRE CLAY CO.
RUTLAND, VT.

G&O COILS

G&O
RADIATION

FOR HEATING AND COOLING IN A WIDE RANGE OF SIZES

Detail of mechanical joint used in Universal Heat Transfer Coils.

Send for Catalog

THE G&O MANUFACTURING COMPANY
New Haven, Connecticut
Pioneer Manufacturers of Square Finned Tubing in the United States

tests were conducted on wall, floor, and roof specimens constructed by gluing and nailing one sheet of plywood between two frames and facing the outer surface with other sheets of plywood. The heat transfer properties of three wall specimens were determined in a shielded hot box heat transfer apparatus.

Copies of this report are for sale by the Superintendent of Documents, United States Government Printing Office, Washington, D. C., for 15c.

Code to Prevent Magnesium Powder Explosions

A code for preventing explosions and fires in plants producing or handling magnesium powder or dust has been developed by the National Fire Protection Association's committee on dust explosion hazards, which also is the American Standards Association sectional committee Z12.

Copies of this new safety code are available from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

Heat Transfer and Pressure Drop in Annuli

The paper Heat Transfer and Pressure Drop in Annuli, by Elmer S. Davis, Alco Products Div., American Locomotive Co., presented at the spring meeting of the American Society of Mechanical Engineers, April, 1943, gives new equations for heat transfer and pressure drop in annular spaces for turbulent and laminar flow. The equations have been checked against most of the data available in the literature and are found to give excellent agreement. For heat transfer, the D_2/D_1 range tested is from 1.18 to 6800, and for pressure drop from 1.0044 to infinity.

The heat transfer and friction factors vary with the same powers as the corresponding cases for flow inside tubes. The friction equation reduces exactly to the conventional equation for flow inside tubes when D_1 approaches zero. For most commercial cases, the new equations give higher rates than the equation for flow inside tubes of the Tubular

PERFORMANCE PLUS
with
Economy
SCV
Pumps

Economy's new vertical type pump for clear liquid services. Highly recommended for hot and cold water circulation, air conditioning systems, brine circulation, sprinkler equipment, boiler feeding, pressure boosting, etc.

- Vertical in design—saves floor space.
- Motor high and dry—away from splash and dirt.
- Complete rotor easily removed without disturbing piping connections.
- Impeller keyed to extra heavy shaft rotates between both an outboard and inboard bearing—smooth and noiseless operation.
- Built in sizes with discharges 1" to 3", for capacities from 10 to 500 GPM, with heads up to 225 feet.

Write for fully illustrated and complete descriptive Catalog No. D2-1042.

ECONOMY PUMPS, INC.
1011 WELLER AVENUE — HAMILTON, OHIO

Exchanger Manufacturers Association, using hydraulic diameter based on either heated or wetted perimeter.

Commercial Standard for Mineral Wool

Commercial standard CS105-43 published by the National Bureau of Standards and entitled Mineral Wool; Loose, Granulated, or Felted Form, in Low Temperature Installations, is a recorded voluntary standard of the trade with an effective date for new production from March 1, 1943.

Copies of this standard are for sale by the Superintendent of Documents, United States Government Printing Office, Washington, D. C., for 5c.

War Standard Revises Ratings of Pipe Flanges and Fittings

At the request of the War Production Board, the American Standards Association, 29 W. 39th St., New York, N. Y., has completed a war standard revising ratings of cast iron pipe flanges and flanged fittings. Approved by the ASA on April 15, 1943, this American war standard pressure ratings for cast iron pipe flanges and flanged fittings, class 125 (B16a1-1943) is available from the association for 20c.

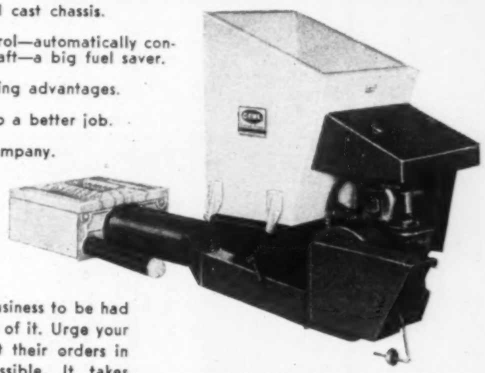
Performance and Selection of Mechanical Draft Cooling Towers

The paper Performance and Selection of Mechanical Draft Cooling Towers, by Joseph Lichtenstein, Foster Wheeler Corp., presented at the spring meeting of the American Society of Mechanical Engineers, April, 1943, indicates the need for standardization in cooling tower practice and the adoption of a common basic theory for correlation of the vast amount of experimental data, coupled with practical experience now available. Such a theory would be invaluable in calculating performance at the guarantee point from test data taken under other conditions of service.

From Merkel's differential equation for the cooling

GEHL STOKERS will get you those HEATING PLANT CONVERSION SALES

- Rust-resisting, all cast chassis.
- Barometric Control—automatically controls chimney draft—a big fuel saver.
- Other sales-winning advantages.
- Engineered to do a better job.
- A 76-year-old company.



There's Stoker Business to be had—get your share of it. Urge your customers to get their orders in as soon as possible. It takes time to arrange Government priorities.

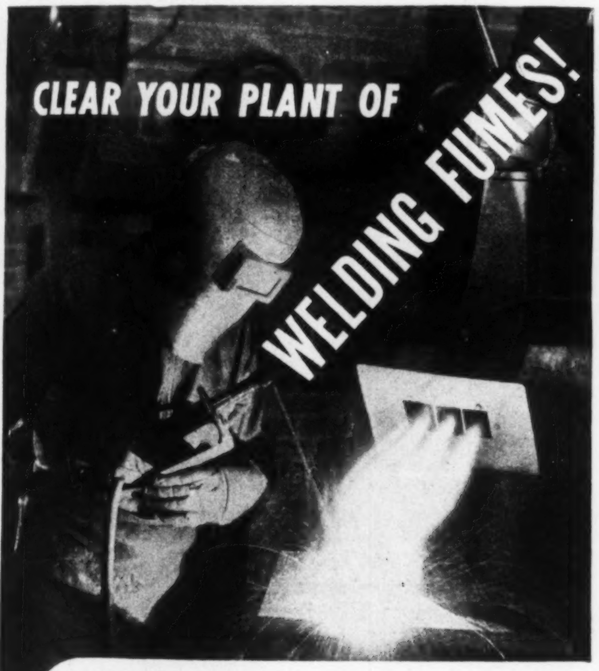
Models for factories, warehouses, public buildings, office buildings, schools and churches.

Write for catalog and our plan of dealer cooperation.

GEHL BROS. MFG. CO.

Established 1867 **Dept. BJ-830, West Bend, Wisconsin**

A GEHL WINS FRIENDS WHEREVER IT GOES



GUARD EMPLOYEE HEALTH by installing Ruemelin Fume Collectors wherever welding operations take place. They remove noxious gases, heat and smoke at the source . . . eliminate employee fatigue . . . speed up welding operations. Especially valuable in winter when doors and windows must be closed. Hundreds in operation all over the country. Write for bulletin No. 37-C.

RUEMELIN MFG. CO., 3896 N. Palmer St., Milwaukee 12, Wis.

RUEMELIN FUME COLLECTOR

GENERAL CONTROLS

HEAT CONTROL in a package for *Homes of the Future*

These ingenious, gas-actuated, automatic control package sets are unbelievably low in cost, but they add a tremendous purchaser appeal to any residence. Handling manufactured, mixed, natural or butane gas, they are suitable for central furnaces, floor furnaces, boilers, radiators, gas ranges, water heaters, etc. B-60 Package Sets include an improved B-60 valve, with tamper-proof cover and integral pilot valve assembly, an ivory and chrome finished Trimtherm thermostat, 30 feet of wire, and a thermocouple pilot generator which provides all current needed for valve operation. Regular thermostats, thermometer thermostats and timer-thermostats available with or without night cut-off. B-60 control systems are safe, quiet, dependable and proved. Check on their many advantages now. Ask for Catalog No. 52.

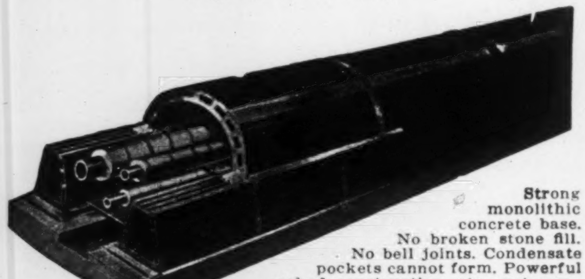
GC **GENERAL CONTROLS**
801 ALLEN AVENUE • GLENDALE 1, CALIFORNIA
Branches: Boston • New York • Philadelphia • Cleveland • Detroit
Chicago • Dallas • Denver • San Francisco

KEEP YOUR INSULATION **DRY**

by using the Underground Pipe Conduit that has an Internal Channel Drain, namely

THERM-O-TILE

Reg. U. S. Pat. Off.



Strong monolithic concrete base. No broken stone fill. No bell joints. Condensate pockets cannot form. Powerful arched construction, etc., yet competitive in final cost. Ask for Bulletin 381.

Sold and installed by Johns-Manville Construction Units in all Principal Cities. See our page in Sweet's or The Heating Guide.

H. W. PORTER & CO., Inc.
822H Frelinghuysen Ave., Newark, New Jersey

Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

Clip your name, firm, and address to this ad; tear out with the checked squares above, mail, and you will hear from us promptly.

POWERS
TEMPERATURE and HUMIDITY
CONTROL

When you want accurate and dependable automatic temperature or humidity control for Industrial Processes or Air Conditioning Systems call in a Powers engineer. With a very complete line of self-operating and compressed air operated controls we are well equipped to fill your requirements.

Write for Circular 2520

THE POWERS REGULATOR CO.
2759 Greenview Avenue, CHICAGO

Offices in 47 Cities—See your phone directory

50 Years of Temperature and ★ Humidity Control ★

tower, the author derives a basic dimensionless equation for calculating cooling tower performance. A graphical method of solution of this basic equation is then given in the form of curves which have been developed by the author's company as a result of extensive tests, which are explained in the paper. It is further shown that the size of a cooling tower for a fixed set of conditions is not entirely determined by theory alone, but that economic conditions constitute the final criterion.

Development and Performance of a Coal Fired Unit Heater

The paper Development and Performance of a Coal Fired Unit Heater, by R. M. Rush, Dravo Corp., presented at the annual meeting of the American Society of Mechanical Engineers, December, 1942, describes an advanced design of coal fired unit heater; explains the means by which high rates of heat transfer comparable to those of heating boilers are attained in an air heater, and by which the steel shell of the combustion chamber is kept at a safe temperature level; and gives results of tests of a large heater of this type.

Various modifications of the installation arrangements are described, and the savings of critical materials and of man-hours, important under the present war conditions and attainable by the use of this type of heater, are pointed out. A design of heater having all refractory heat transmitting surfaces is also described. The reasons why the overall saving of metal effected by the last mentioned design must be disappointingly small are explained.

A Course in Powder Metallurgy

Almost any engineer would have a ready answer if asked what aspects of industry will loom large in our postwar economy. Among the fields that undoubtedly would be mentioned are electronics, plastics, magnesium and aluminum, aircraft, or other branches of science and technology where obvious important advances have been made recently; all these await only the coming of peace so that adequate steps may be taken toward their commercial development. But many engineers might not mention powder metallurgy, so undramatic has been its growth.

The recent publication of a textbook, A Course in Powder Metallurgy, by Walter J. Baëza, president of the Industrial Research Co., consultant, and instructor at the College of the City of New York, should serve to focus attention upon a very recent newcomer to join the ranks of what was once an ancient art—metal working. Briefly, powder metallurgy is the technique of producing metals in a finely divided state, and of producing metals and alloys and metal shapes from these powders at temperatures below the fusion point. In a sense, powder metallurgy is a revival of a very old art, for prior to about the year 1800 men lacked the means of smelting and molding iron above the fusion point. During preceding centuries, iron objects were made from sponge iron. The present day applications, of course, are employed for different reasons, as for instance the producing of metals and alloys that cannot be prepared by fusion methods, or fabrication of metal shapes with special forms or properties, such as porous bronze bearings which soak up lubricating oil.

The book is written principally as a guide to both instructor and student in college courses in powder metallurgy. For that reason, perhaps, it should be equally useful to most engineers; the subject is so new they will have to approach it as students. The text carries frequent reference to the technical literature, which will assist anyone seeking broader information on any one of the many topics discussed. The first half of the book considers metal powders, their production, properties and classification, cohesion and the effects thereon of pressure and heat, manufacturing problems, and machines. The last half is devoted to college courses, laboratory equipment, and laboratory experiments.

It is possibly too soon to predict just how far powder metallurgy will carry into the realm of metal working. But there is room for thought about processes that can fabricate metal parts within the accuracy of lathe turned parts simply by molding, pressure, and heat. One has to ponder the possibilities of a process that can compress tungsten powder into an ingot which, after heat treatment below the melting point, yields a metal with a tensile strength of nearly 600,000 psi, and which can be drawn into wire smaller than 0.001 in. diameter. Perhaps the scope of powder metallurgy will be limited only by the imagination of those who learn to fashion metals by the newer techniques.

This book is published by the Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y. It has 212 pp., 6 in. x 9 in., and sells for $3.50.—K. S.

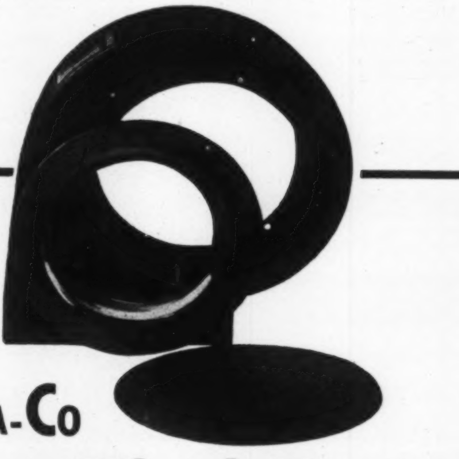
Pocket Manual of Arc Welding

The recently issued Pocket Manual of Arc Welding is a handy 128 p. book designed for the welding operator and supervisor as a source of quick information. Edited by Clayton B. Herrick, there is information on welding electrode consumption, speed tables, selection of electrodes, basic welding metallurgy, comparative electrodes by trade name, production welding, weld inspection, and control of distortion.

The publisher is the Industrial Publishing Co., 812 Huron Rd., Cleveland 15, Ohio, and the price is 50c per copy.

Controlled Air Supply for Aircraft Engine Testing

In a paper presented at the 30th spring meeting of the American Society of Refrigerating Engineers in Cleveland and published in the August issue of the ASRE's journal, Refrigerating Engineering, Chas. S. Leopold, consulting engineer, and member of HPAC's board of consulting & contributing editors, described an apparatus in an aircraft engine plant for delivering air to the test blocks at any required dew point at or below saturation. The apparatus as designed provides for 25,000 lb per hr of aviation



DE-STA-CO

Blower Wheel Housings

of Standard Dimensions

Made in sizes to fit 4½, 5, 6, 7½ and 9 inch wheels and in widths to suit single or double inlet wheels . . . also individual parts for your own assembly.

De-Sta-Co housings are engineered for maximum efficiency and quietness in operation . . . neatly finished. Send for "De-Sta-Co Blower Housings" bulletin; gives complete information, including essential dimensions.

DETROIT STAMPING CO.
Established Over 25 Years
337 Midland Ave • Detroit, Mich.

HYDRON

HYDRON
Metal Bellows

Metallic Bellows

● We manufacture bellows and bellows assemblies ready for installation in steam traps, relief valves, temperature regulators, pressure regulators, air valves, and other automatic temperature and pressure controls. Complete engineering service.

CLIFFORD MANUFACTURING CO.

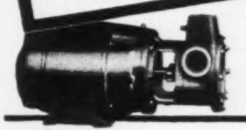
CHICAGO
221 N. LaSalle Street

465 East First Street
BOSTON, MASS.

DETROIT
1847 W. Bethune Ave.

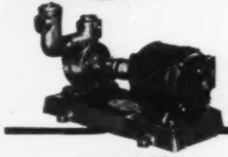
Westco PUMPS
Serve All Industries
Large and Small

There is a size and type of Westco unit to meet important water moving requirements in practically every industry. Among the wide range of Westco equipment, the following are typical:



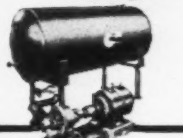
THE WESTCO UNIBILT PUMP

. . . an extremely compact, rugged pump for general purpose applications at low and medium heads. Ideal as sump pump, pressure pump, circulating pump, etc., where space is a limitation. Capacities to 100 GPM. Heads to 300 ft. Both self-priming and non-self priming types.



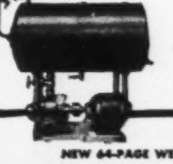
THE WESTCO FLEXIBLE COUPLING PUMP

. . . recommended for general purpose applications at medium and high heads. Excellent for water supply service, heavy duty pressure and circulating work, etc. Capacities to 200 GPM. Heads to 500 ft. Self-priming and non-self-priming types. For hot and cold liquids.



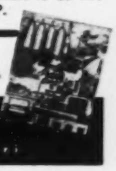
WESTCO CONDENSATE RETURN UNIT

. . . returns condensate to boiler at highest possible temperature, effecting important fuel savings. Automatically compensates for extreme head variations, assuring positive return against fluctuating pressures. Compact, rugged. Sizes to 100,000 sq. ft. of radiation. Pressures to 150 lbs.



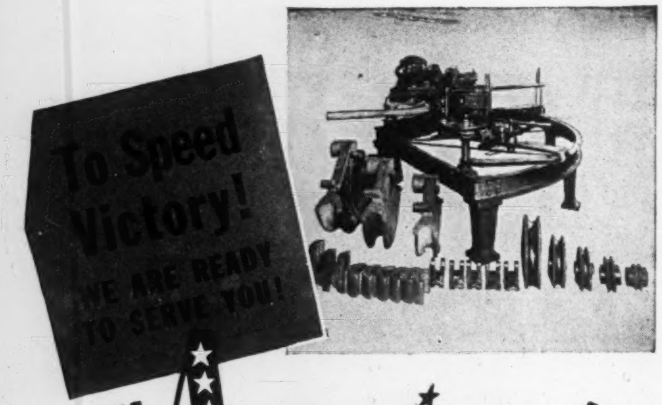
WESTCO BOILER FEED UNIT

. . . insures uniformly-even boiler feed to maintain highest possible boiler temperatures with minimum firing. Automatically maintains uniform water level and steam space in the boiler, increasing boiler efficiency. Internal Make-up type for boilers to 25 HP. External Make-up for boilers to 750 HP.



NEW 64-PAGE WESTCO CATALOG. SEND FOR YOUR FREE COPY.

JOSHUA HENDY IRON WORKS
Pomona Pump Co. Division
2621 Locust Avenue St. Louis 3, Missouri



"American"

COLD PIPE, CONDUIT and TUBE BENDING MACHINES

Twelve types to select from. Hand operated capacities ¼ to 6" inclusive. Motor operated ¾ to 8" inclusive.

A [illegible] Customers: Kaiser Shipbuilding Co.; Bethlehem-Highham Shipyards; Portsmouth Navy Yard; Moore Drydock Co.; Stone & Webster Engineering Corp.; E. I. Du Pont de Nemours & Co.; West Penn Power Co.; Illinois Central Railroad; Federal Pipe & Supply Co.; Alabama Drydock Co.; Westinghouse Elec. & Mfg. Co.; Todd-Bath Shipbuilding Co.

Write Air Mail for printed matter.

"American" PIPE BENDING MACHINE Company INC

Quick Deliveries

51 PEARL ST.
BOSTON, MASS.

★Downright DEPENDABILITY

for day after day, year after year service... Proved by thousands of users everywhere

FIRE-GUARD

Automatic Coal Stokers

Industrial Sizes: 70, 100, 150, 200, 300 and 400 pounds per hour capacity
--also built in domestic sizes

PEERLESS MFG. CORP.
INCORPORATED
Louisville, Ky.

"standard" air of which 12,500 lb can be cooled to —67 F without visible condensation or frost. The design combines adsorption dehumidification and sensible cooling by well water and refrigeration. The process involves precooling and dehydration by silica gel with three stage low temperature refrigeration for further cooling as required.

In his paper Mr. Leopold described conditions at the site, and the analysis of the problem, and he gave a comparison of adsorption and straight refrigeration methods.

Standards for City Gas Piping

According to Industrial Standardization, published by the American Standards Association, 29 W. 39th St., New York, N. Y., new provisions which are expected to serve as a basis for modernizing municipal and insurance company requirements in the city gas piping field have been added to the NFPA standards for the installation, maintenance, and use of piping and fittings for city gas. It is expected that the revised standard will be submitted to the American Standards Association for approval as a revision of the earlier American standard Z27-1933.

The revised standard was adopted by the National Fire Protection Association as an NFPA standard at its annual meeting in May.

Coming Events

National Safety Congress

National Safety Congress, October 5-7, Sherman, LaSalle, and Morrison hotels, Chicago, Ill. A labor and safety session on October 7 is a feature of the program. This is the annual convention of the National Safety Council, 20 N. Wacker Dr., Chicago 6, Ill.

The ENEMY *of*
- SCALE
- RUST
- SLIME
- DIRT
- ALGAE

● **SOL-VET "08"** is a fast, efficient cleaner of all equipment using water for cooling. By dissolving impurities *completely*, they are carried out *in solution*, thus preventing clogging. Head pressures fall to normal; heat transfer is raised to maximum; full circulation is restored; life of equipment prolonged. On large jobs, shutdown time is cut to a maximum of 6 to 8 hours.

GUARANTEED EFFECTIVE If you find SOL-VET "08" is not exactly as represented, when used according to instructions and full, accurate report is given within 30 days from date of purchase, your money will be *refunded in full.*

GUARANTEED HARMLESS when used as directed, to all water conducting materials used in water cooled equipment.

WRITE TODAY for complete data and analysis and recommendations for your specific problems.

SOL-VET "08"
Water Treatment Formula
MANUFACTURED and GUARANTEED by
ANDERSON-STOLZ CORPORATION
1733 WALNUT STREET • • • KANSAS CITY, MISSOURI

Welding Engineers

American Welding Society, 24th annual meeting, October 18-21, Hotel Morrison, Chicago, Ill., in conjunction with Wartime Emergency Metal Congress to be held at the Palmer House. Tentative program includes papers on investigation of a normalizing procedure to improve the grain structure of welds in carbon molybdenum pipe, by I. A. Rohrig, D. H. Corey, and Sabin Crocker, The Detroit Edison Co.; oxyacetylene distribution systems, by D. F. Guthrie and R. W. Stewart, Air Reduction Sales Co.; large welded pipe lines, by L. G. Christofferson, Chicago Bridge & Iron Co.; weldability of 27 per cent chrome steel pipe, by R. A. Mueller, I. H. Carlson, and E. R. Seabloom, Crane Co.; welded steel tubing quality control and application, by R. D. Malm, Clayton Mark & Co.; fabrication and welding of aircraft exhaust tubing manifolds and headers, by C. D. LaFond, Buhl Stamping Co.; metallic arc welded steel tubing, by W. T. Tiffin, University of Oklahoma; oxyacetylene tube welding, by A. C. Weber, Laclede Steel Co.; inspection of arc welding for pressure vessels and piping, by W. D. Halsey; and war emergency codes for welded pressure vessels, by E. R. Fish, Hartford Steam Boiler Inspection & Insurance Co. Headquarters office of the American Welding Society is at 33 W. 39th St., New York 18, N. Y.

Heating and Ventilating Engineers

American Society of Heating and Ventilating Engineers, 50th annual meeting, January 31-February 2, Hotel Pennsylvania, New York City. A special program dealing with the past, present, and future is being planned. Secretary, A. V. Hutchinson, 51 Madison Ave., New York 10, N. Y.

Foundry Congress

American Foundrymen's Association, third war production foundry congress, week of April 25, Memorial Auditorium, Buffalo, N. Y. There will be exhibit booths for conference and consultation and displays of models, products, and equipment. Secretary of the AFA is R. E. Kennedy, 222 W. Adams St., Chicago, Ill.

GET THAT AIR OUT OF THERE

With an
AUTO-VENT AIR ELIMINATOR

Circulation Troubles?

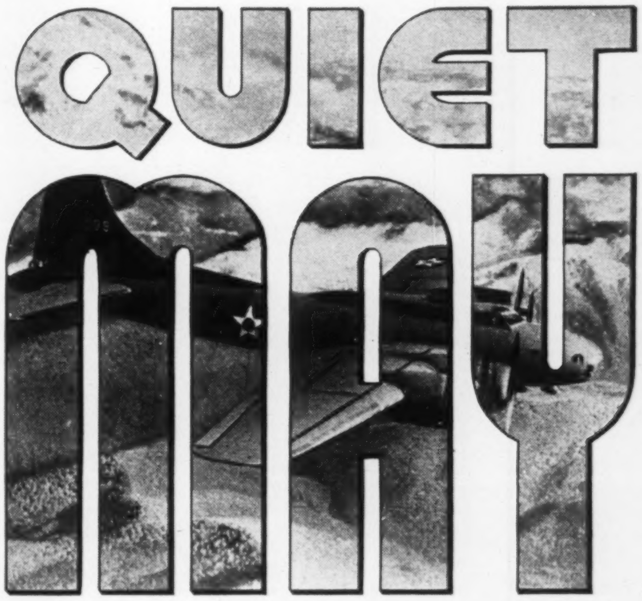
Why continually fight air pockets or traps in hot or cold circulating lines? You can "get that air out of there" *and keep it out* simply by installing the No. 7 Maid-O'-Mist Automatic Air Vent. This reliable air vent has a self-closing float-controlled valve and is designed especially for circulating pipe lines, concealed radiators, unit heaters, cooling manifolds, tanks, diesel engines, or any other application where air pockets or traps retard the free circulation of liquids.

Now available in bright brass finish.

APPROVED FOR NAVY, MARITIME COMMISSION AND ARMY USE.

MAID-O'-MIST INC.
211 NORTH ABERDEEN STREET
CHICAGO 7, ILLINOIS

AUTOMATIC
HUMIDIFIERS
FOR ALL TYPES OF HEATING SYSTEMS



OIL BURNERS

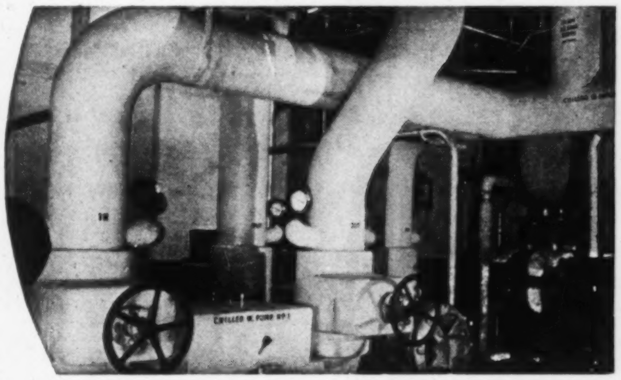
● On land, on sea, and in the air . . . Quiet May Oil Burner's famed Gerotor pump is doing a fine job for Uncle Sam. When this war is won, Quiet May will be back on the job for you too.

MAY OIL BURNER CORPORATION
Baltimore, Md.

CORK INSULATION

Now Available for Air Conditioning!

(NO PRIORITY REQUIRED)



Mundet Cork Pipe Covering is made of 100% pure cork, which, due to its low conductivity holds power costs to the minimum. Its high efficiency permits precise control of low temperature regardless of climate or season ● Cold lines, low-temperature ducts, the walls, floors and ceilings of refrigerated rooms should be adequately protected by Mundet Cork Insulation in the form of Cork Pipe Covering and Corkboard ● For test data, showing what Mundet Cork Insulation means in savings and operating efficiency, write to Mundet Cork Corporation, Insulation Division, 65 South Eleventh Street, Brooklyn, N. Y.

MUNDET CORK INSULATION
CONSERVES LOW TEMPERATURE

NOZZLES
for Air Washing

Yarway Involute Design—with no internal parts or vanes — insures non-clogging trouble-free service. Sizes and types to meet all requirements. Successful installations of Yarway Involute Nozzles in water cooling and air conditioning service total more than 5 million gallons per minute. Write for Bulletin N-616.

YARNALL-WARING CO.
107 MERMAID AVE., PHILA. 18, PA.

YARWAY

a UNIT HEATER

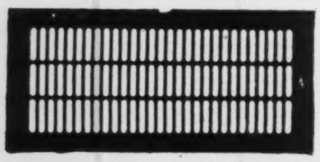
THAT WILL LAST LONGER THAN OTHER TYPES OF HEATING EQUIPMENT—

DESIGNED and tested to operate with either steam or hot water—up to 250 lbs. steam pressure. Lower outlet temperatures . . . greater air volume . . . more air changes per hour . . . no electrolysis to cause corrosion. Each "fin" heating section cast in one piece of high test cast iron . . . no heating failures . . . no leaks . . . no breakdowns . . . no maintenance expense. Made in 9 sizes—Patent applied for. *Territory open for high grade distributors*

CAST IRON HEATING SECTIONS

D. J. MURRAY MFG. CO.
WAUSAU, WISCONSIN

GRID UNIT HEATER



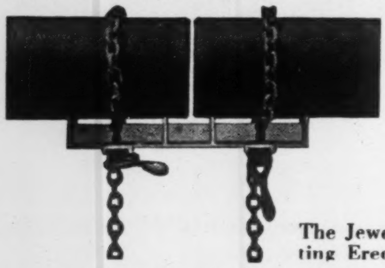
War Products Come First!

Auer is now engaged principally on vital aircraft parts and other war-time products. We are still able to furnish most styles of registers from inventory stocks, for all purposes permitted by Federal regulations. We are also well equipped for sub-contracts on metal stamping and fabricating, in gauges 10 to 24, and invite your inquiry on priority war goods.

Auer Register Book sent on request.

THE AUER REGISTER COMPANY, Cleveland, O.

AUER REGISTERS
& GRILLES · For Air Conditioning *and* Gravity



PIPE WELDING TOOLS THAT MAKE WELDING PAY

Pipe Clamps
Flange Clamps
Elbow Clamps
Angle Clamps
Pipe Markers

TWO SIZES
½ to 8 in. 8 to 16 in.
Light—Adjustable—Fast

The Jewel System of Pipe and Fitting Erection Ready for the Weld

Keeps the Welder Welding Instead of Waiting
CUTS ERECTION COSTS
Modernize Your Own Methods and Tool Equipment

JEWEL MANUFACTURING COMPANY
1841 University Ave., St. Paul, Minn.

Industry Can Provide Jobs For All After the War

THE PUBLISHER—

A recent editorial in the Kansas City Star dealt with the subject of jobs for the soldiers as they return home, and emphasized that it was a problem facing industry rather than the government.

The editorial was 100 per cent right. Tax money spent to make jobs which are unnecessary is wasted money and wasted money, as we have seen exemplified for 10 or 12 years, does not bring prosperity no matter how good the intentions may be.

In my judgment, industry is ready; not only willing, but able to provide all the jobs needed to take care of the soldiers and to provide additional jobs for those already in industry who have replaced soldiers, providing they want to stay.

That ability, however, must be predicated on two things. First, that industry be no longer made the whipping boy of the politicians. It has been the favorite stunt of certain politicians to assail industry in order to make votes for themselves, and, unfortunately, it has succeeded. But that must change!

American people must realize that the thing that has made America powerful in this war is our industry. Take the single item of constructing camps for the Army. The construction industry has made that possible and a tremendous construction task which faced it was bigger than anything it had ever faced before. There may have been abuses but no more abuses on the part of industry than there were on the part of the Army. They get the job done in a hurry.

Our automobile industry changed over in an incredibly short time to the production of things needed to fight the battles, and it is a fact that American industry, organized as it was, was able to do these things in spite of interference from Washington. That ability has made the winning of this war possible.

So it is time that the American people rescued our industry from the position of whipping boy for the politicians. Politicians will stop that sort of thing just as soon as the American people realize that an attack on industry is an attack on the *good living* which the American people have enjoyed as a result of the success of its industry.

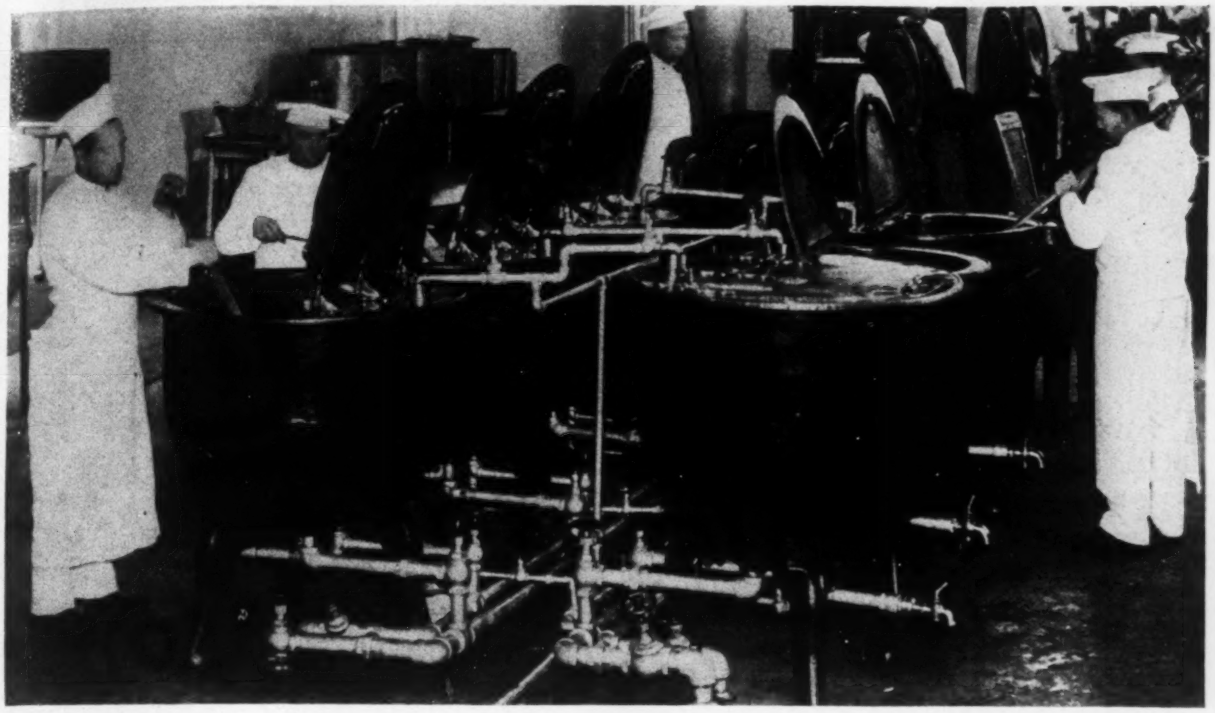
Two things are needed to make it possible for industry to assume the obligation of providing all the jobs needed when the war is over.

The first is that all governmental restrictions of every sort and kind on the purchase of materials, the hiring of men, and the selling of equipment shall be removed instantly, all at once.

We hear many statements nowadays that the government officials at the present time have no intentions of letting loose. The people must demand that they let loose, that they free industry from the shackles that they have put on it in the name of war.

The second thing required is that the extreme excess profits taxes shall be reduced. Industry must be allowed to accumulate money to plough back into the business. That has been the life blood, the development capital, of American business since its beginning. There are thousands of concerns in the United States, large and small, which have started from small beginnings and as they have made profits they have reinvested them in the business. That procedure is practically impossible under the present tax setup. Taxes must be, in order to pay for the extravagances of the past 12 years and for the war, but punitive taxes should be abolished, and industry should be allowed sufficient reserve capital to meet the reconversion problem both as to its equipment, as to its men, and its new business.

If these two things are done, the government can just as well quit planning on any public money program from the standpoint of furnishing jobs. Industry will do it, but the shackles which the government has put on industry must be removed. If they are removed, industry will do for the country, after the war, what it has done for the country during the war.—E. K. CAMPBELL, E. K. Campbell Heating Co.



CHOW!

FOOD AND WATER ARE ESSENTIAL IN WINNING THIS WAR.

Piping for cooking food and bringing water requires malleable iron fittings.

"MIF" malleable fittings are all made from Air Refined Malleable thus assuring added safety.

MIF

Trade Mark

SERVICE FOR FREEDOM

MALLEABLE IRON PIPE FITTINGS
BRANFORD BRASS SEAT UNIONS

MALLEABLE IRON FITTINGS CO., BRANFORD, CONN.

Helping to Widen
YOUR POST-WAR MARKET

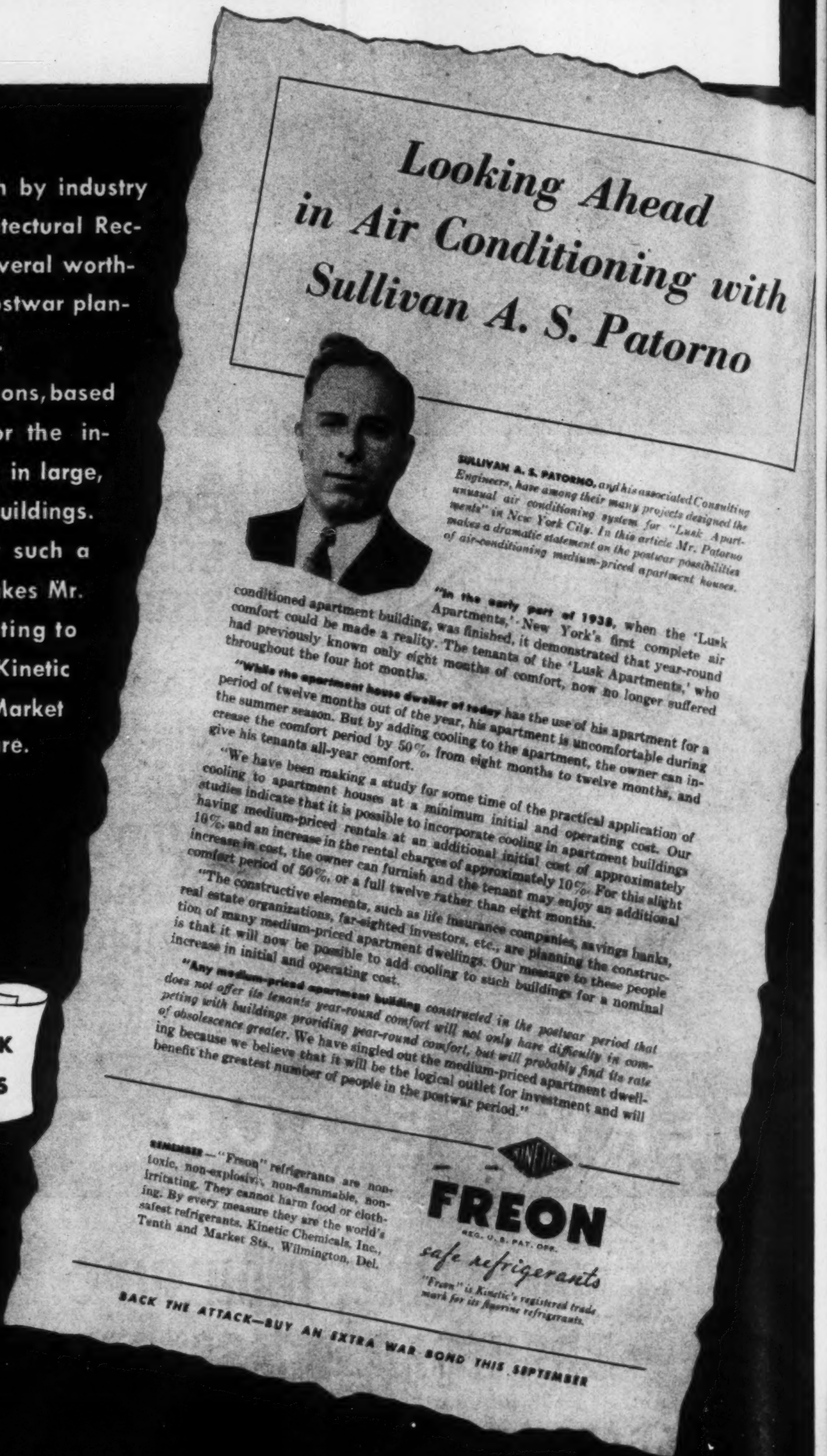
In this statement, the fourth by industry leaders to appear in "Architectural Record," Mr. Patorno makes several worthwhile suggestions for the postwar planning of apartment buildings.

He advances excellent reasons, based upon actual experience, for the installation of air conditioning in large, medium-priced apartment buildings. The new and wider market such a development will create makes Mr. Patorno's message interesting to architects and engineers. Kinetic Chemicals, Inc., Tenth & Market Streets, Wilmington, Delaware.

KINETIC
REG. U.S. PAT. OFF.

BACK THE ATTACK WITH WAR BONDS

Published in the interest of air conditioning and refrigeration.



Looking Ahead in Air Conditioning with Sullivan A. S. Patorno

SULLIVAN A. S. PATORNO, *and his associated Consulting Engineers, have among their many projects designed the unusual air conditioning system for "Lusk Apartments" in New York City. In this article Mr. Patorno makes a dramatic statement on the postwar possibilities of air-conditioning medium-priced apartment houses.*

"**In the early part of 1938,** when the 'Lusk Apartments,' New York's first complete air conditioned apartment building, was finished, it demonstrated that year-round comfort could be made a reality. The tenants of the 'Lusk Apartments,' who had previously known only eight months of comfort, now no longer suffered throughout the four hot months.

"**While the apartment house dweller of today** has the use of his apartment for a period of twelve months out of the year, his apartment is uncomfortable during the summer season. But by adding cooling to the apartment, the owner can increase the comfort period by 50%, from eight months to twelve months, and give his tenants all-year comfort.

"We have been making a study for some time of the practical application of cooling to apartment houses at a minimum initial and operating cost. Our studies indicate that it is possible to incorporate cooling in apartment buildings having medium-priced rentals at an additional initial cost of approximately 10%, and an increase in the rental charges of approximately 10%. For this slight increase in cost, the owner can furnish and the tenant may enjoy an additional comfort period of 50%, or a full twelve rather than eight months.

"The constructive elements, such as life insurance companies, savings banks, real estate organizations, far-sighted investors, etc., are planning the construction of many medium-priced apartment dwellings. Our message to these people is that it will now be possible to add cooling to such buildings for a nominal increase in initial and operating cost.

"**Any medium-priced apartment building** *constructed in the postwar period that does not offer its tenants year-round comfort will not only have difficulty in competing with buildings providing year-round comfort, but will probably find its rate of obsolescence greater.* We have singled out the medium-priced apartment dwelling because we believe that it will be the logical outlet for investment and will benefit the greatest number of people in the postwar period."

REMEMBER—"Freon" refrigerants are nontoxic, non-explosive, non-flammable, nonirritating. They cannot harm food or clothing. By every measure they are the world's safest refrigerants. Kinetic Chemicals, Inc., Tenth and Market Sts., Wilmington, Del.

KINETIC

FREON
REG. U.S. PAT. OFF.
safe refrigerants

"Freon" is Kinetic's registered trade mark for its fluorine refrigerants.

BACK THE ATTACK—BUY AN EXTRA WAR BOND THIS SEPTEMBER

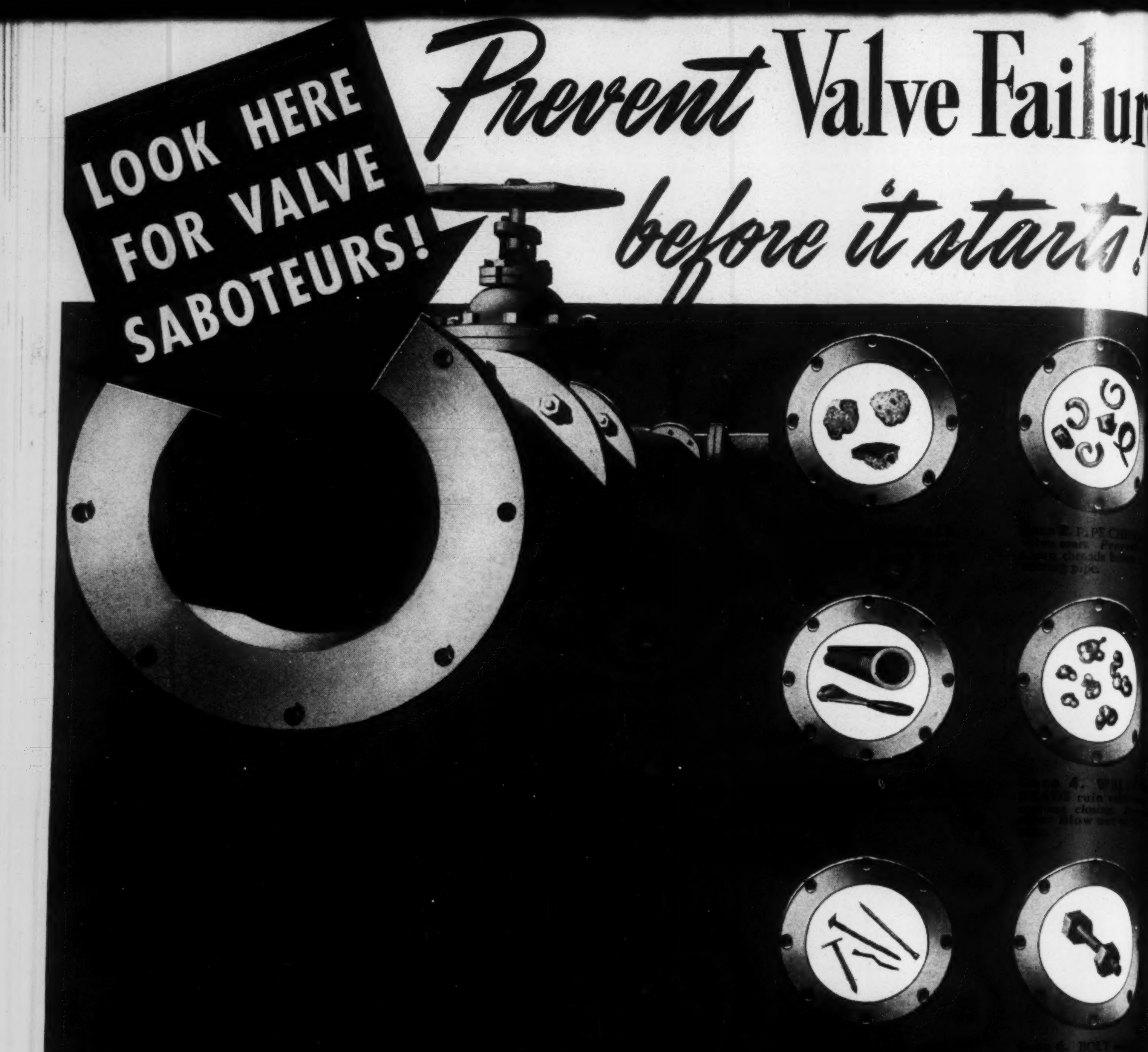
Personalized HEATING CONTROL

M-H Personalized Heating Control is a logical development for apartments. Not only does it enable tenants to select exactly the temperatures they need or desire in their apartment, but it may also permit them to choose the temperature in sections or rooms of their own apartment. In an independent survey, 84% of apartment tenants held Personalized Heating Control necessary, and 48% stated they would be glad to pay extra rent for it . . . Heating engineers, architects and apartment operators will be interested in our booklet, "Personalized Heating Control for Apartments" . . . Write for it. Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave. S., Minneapolis 8, Minn.

Buy More War Bonds!

MINNEAPOLIS-HONEYWELL

TEMPERATURE CONTROLS


LOOK HERE FOR VALVE SABOTEURS!
Prevent Valve Failur
before it starts!
[illegible] 2. PIPE CHI
valve seats. Preven
[illegible] threads befo
[illegible] pipe.
[illegible] 4. WHI
[illegible] ruin va
[illegible] closing.
[illegible] Blow out
[illegible] 6. BOLT
[illegible] in gate va
Prevention: In
[illegible] to be carefu
[illegible] 8. JOIST
[illegible] check valve
Prevention: See that
[illegible] are clean.
[illegible] 10.

For
any
new
Sec
Pip
sou
uste
Sec
not

Sel
Dri

N
was
serv
250,
stan
the
the
driv
they
mor
plac
mat
the
tan
C
driv
tan
tors
side
tion
hav
cial
plat
mos
long
how
thos
emp
plac
rath
an a
save
ditio
F
are
ings
high
fron
For
est
diam
will
ing
the
belt

H
and
will
near
"A"
sequ
are
diam
savi
spac

K
for
ques
one

Hea

• EQUIPMENT DEVELOPMENTS •

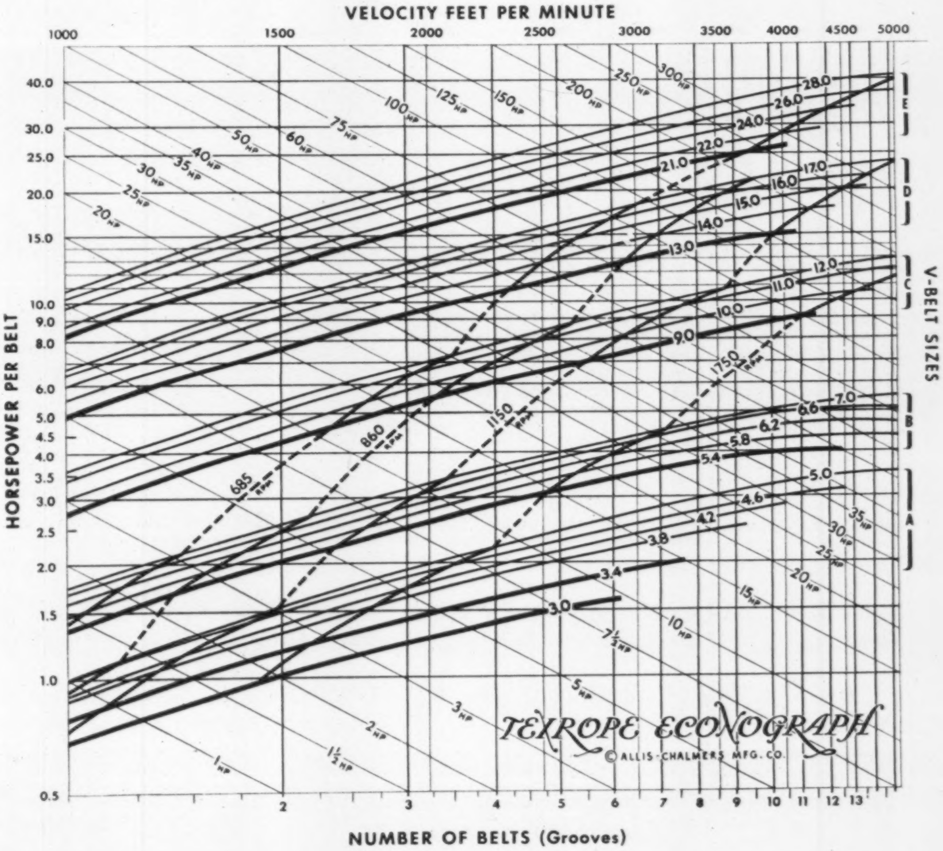
For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1943, Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed.

Selection Plan for V-Belt Drives Conserves Rubber

No. 2492—A conservation plan for V-belt drives, which was announced recently and is based on the need for conserving crude rubber, can save 250,000 lb of this vital substance annually, sponsors of the plan state. By following the program, users of V-belt drives not only save rubber; they also can make substantial money savings on new and replacement drives. The estimated savings are based on the use of shorter center distances and larger sheaves.

One problem, peculiar to fan drives, makes short center distances impractical. Since motors cannot be attached to the side of the fan due to vibration, they would necessarily have to be mounted on specially-constructed pillars or platforms, which would in most cases cost more than longer V-belts. In many cases, however, shorter drives than those used at present could be employed if the motor were placed at the side of the fan rather than at the end. Such an arrangement can sometimes save enough space for an additional fan.

Fan installations, however, are such that important savings can be made by using higher belt speeds, as well as from the use of larger sheaves. For each belt size, the smallest sheave is the minimum diameter over which the belts will bend without excessive heating and consequent shortening of life. Similarly, the largest sheave in each case is the maximum pitch diameter beyond which no increase of belt horsepower capacity is obtainable.



Horsepower per belt increases both with sheave diameter and belt velocity. For example, at 2500 fpm, an "A" belt will carry a little less than 1.5 hp over a 3.0 in. sheave, but nearly 2.5 hp over a 5.0 in. sheave. By going to 4000 fpm, "A" belts will carry about 3.3 hp over a 5.0 in. sheave. Consequently, fewer V-belts and sheaves with fewer grooves are needed to do the same job formerly done by smaller diameter sheaves and a greater number of belts. These savings are possible where fans are concerned because space considerations are not usually of prime importance.

Knowing that the most efficient drive will save money for the V-belt user, it is natural for him then to ask the question, "How will I determine which drive is the correct one for my needs?"

The "Texrope Econograph" was devised to answer this question. This graphical method for selecting the right sheave diameters and belt sizes makes it possible to solve for six variables in one operation. These variables are horsepower per belt, velocity in feet per minute, driving sheave diameters, belt size, revolutions per minute, and number of belts or grooves. Starting with the two known factors, speed and horsepower of motor, and the largest diameter of the driven sheave which can be accommodated and the corresponding diameter of the small sheave to suit the ratio desired, it is possible to choose the right drive from this chart.

With the chart, a man preparing to design a V-belt drive can visualize how the number of belts for any drive becomes less and less as sheave diameter and belt velocity becomes higher and higher. When the number of belts for any drive is reduced, rubber is saved. Also, complete drives with fewer belts usually cost less than complete drives which have a greater number of belts. With the exception of extreme drive changes from small sheaves to very large ones, the added cost for iron of larger sheaves is more than

Heating, Piping & Air Conditioning,
6 N. Michigan Ave., Chicago 2, Ill. [10-43]

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature.

(Circle each number in which you are interested)

2492 2493 2494 2495 2496 2497 2498 2499 2500
2501 2502 2503 2504 2505 2506 2507 2508 4540
4541 4542 4543 4544 4545 4546 4547 4548 4549
4550 4551 4552 4553 4554 4555 4556 4557 4558
4559 4560

Name.............................. Title..............

Company ....

Address ....

City.............................. State..............

WARTIME EXPERIENCE

points to

POSTWAR PERFECTION

Since automatic controls are essential to modern, mechanized warfare, the greater part of our production is devoted to turning out vitally necessary precision built equipment.

The specialized skills used to hasten the day of Victory will also serve after the peace is won. When that day comes, knowledge gained from wartime experience will be used to good advantage.

Automatic controls will give the American of tomorrow even higher standards of living and production efficiency than those now enjoyed. We will be ready to maintain our reputation as pioneers and leaders in this field.

V-200 THERMAL EXPANSION VALVE

FEATURES

- Readily removed orifice cartridges eliminates necessity for stocking several sizes for low tonnage installations.
- Carefully lapped hard faced ball insures positive tight shut-off.
- Thoroughly field tested.
- Handles freon, methyl chloride, sulphur dioxide.

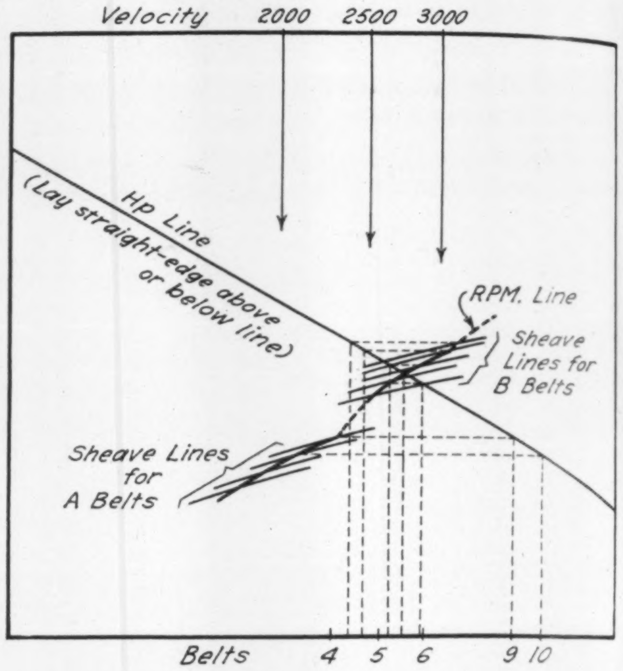
GENERAL CONTROLS
801 ALLEN AVENUE GLENDALE 1, CALIFORNIA
BOSTON • NEW YORK • PHILADELPHIA • DETROIT
CHICAGO • CLEVELAND • DALLAS • DENVER • SAN FRANCISCO

---

offset by the cost of machining the additional grooves of smaller diameter sheaves.

Since belts bend less severely over larger sheaves, they last longer. The flexing factor in V-belts that operate on large diameter sheaves is comparatively negligible. Excessive bending produces excessive internal friction, baking the life out of the rubber binder which holds the pulling cords together. V-belts that are split along the pitch line indicate that they were run over too small a sheave.

The disadvantage in using higher velocity drives is that the drive is larger in diameter dimension. This is a relative difficulty, however, because a slight increase in space allowed for a drive is often enough to produce the savings. In the case of a fan drive, where the whole drive is in the open, the larger dimensions are not usually objectionable. In other cases, where the drive is built into a machine tool, for example, smaller dimensions are required, but here again the designer needs only slightly more space.



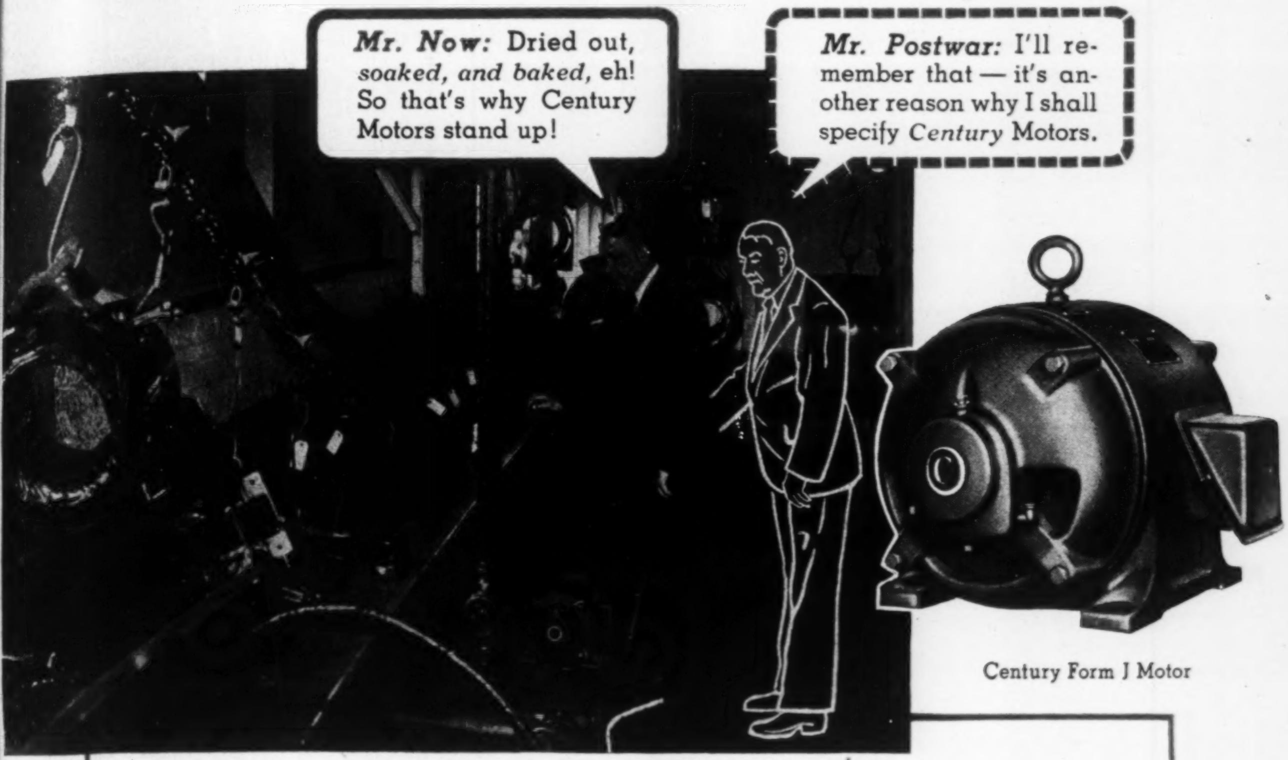
One fallacy in the argument that drives must have small diameter sheaves is that, if diameters are kept small, widths must be increased to accommodate more belts. Again, in the case of fan drives, greater sheave widths might cause excessive overhang on the fan shaft, consequently causing wear on the bearing. Continued bearing wear is liable to create vibration noise in the fan which would be transmitted throughout the ventilating system.

A glance at the chart will show that "A" belts carry maximum horsepower per belt at about 4000 or 5000 fpm over 5.0 in. sheaves. Theoretically, this is the only sheave size and velocity that should be offered for "A" belts, but practically there is a need for smaller diameters to suit varying dimensional limitations that cannot be eliminated, such as applications to old machines, clearances for aisles or obstructions, etc.

The aim should always be to use the most economical drive because that always means the most efficient utilization of rubber belts and provides for the longest V-belt life.

Following is an example of the use of the sheave selector chart. Referring to the skeleton chart, first lay a straightedge along the horsepower line. Then from the intersections of the rpm line with the sheave lines, project horizontally to the hp line, as shown by the dotted lines. Then go vertically to the bottom of the chart to the belt scale, and read the number of belts.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Take a Look at TOMORROW—*Today!*


Mr. Now: Dried out, *soaked, and baked,* eh! So that's why Century Motors stand up!
Mr. Postwar: I'll remember that — it's another reason why I shall specify *Century* Motors.

Century Form J Motor

The Protection of
CENTURY INSULATION
Assures Continuous Motor Performance Under the Toughest Conditions

By the use of slow-moving conveyors and automatically-controlled ovens, the completed stator and winding of Century Motors is dehydrated, and then is submerged in and passes through a tank filled with Century "Clingto" insulating varnish, and then baked. This process is repeated as necessary to preserve and seal the winding into a homogeneous mass.

This is followed by a final coat of Century "Protecto" insulation compound which places a heavy exterior protecting armor over the entire winding.

Century slot insulation is built up with fibre board for mechanical strength and varnished cloth for dielectric strength.

The entire Century insulation process produces a winding that is highly resistant to moisture, to tropical climatic conditions, to mild acid and alkali fumes, and to the effect of magnetic vibration and the mechanical impact of particles carried by the cooling air.

Such insulation material and treatment is absolutely necessary for motor protection for long operating life.

Your nearest Century Application and Service engineer will gladly give you full details of all the advantages of Century Motors—show you why thousands of plants rely on Century for continuous, all-out production.

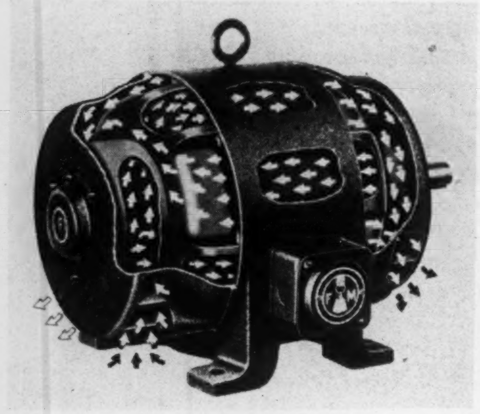
Century
MOTORS
1/6 to 600
horsepower

CENTURY ELECTRIC CO.
1806 Pine Street
St. Louis, Missouri
Offices and Stock Points in Principal Cities

307

One of the Largest EXCLUSIVE Motor and Generator Manufacturers in the World.

Squirrel Cage Induction Motor



No. 2493—A new all purpose continuous duty, polyphase squirrel cage induction motor for use in all kinds of industry is "protectioneered" and, according to its manufacturer, embodies many special features.

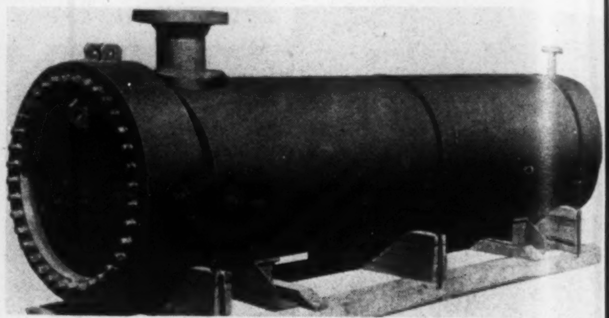
Constructed with the centrifugally cast "F-M copperspun" rotor, this motor is fully protected against flying chips, falling particles, dripping liquids, and other industrial motor hazards. The ball bearings, sealed in cartridge type housings, minimize shutdowns due to bearing failures. Cross flow ventilation, a feature in frames "224" to "365" inclusive, is obtained through protected inlets and exhausts at each end of the motor.

The frame is cast in one piece with rib sections to give added strength without increase in weight.

An innovation in conduit boxes is incorporated. Where space is limited, the conduit can be brought up between the motor feet to the tapped hole in the motor frame and the conduit box cover assembled flush with the frame. The external box is then discarded. When the conventional conduit box is used it can be mounted in any one of four positions.—Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

Pipe Line Filter

No. 2494—To protect valve seats, pumps, and meters in pipe lines handling petroleum products against damage from solids and dirt particles, "Alco" filters offer improvements in three essential features, says the maker: increased filtering capacity; decreased time out for recharge of filter and ease of dismantling and assembling.



Increased filtering capacity is achieved by a radical reduction in the velocity of the liquid upon its entrance into the filter, and, by directing the flow through the filter from the outside of the basket to the efflux pipe in the center, initial contact with the filtering media is made where its area is the maximum. This design permits these pipe line filters to be kept on stream at full rated discharge capacity for long periods of time.

Construction of the filter permits a minimum off stream period. Bolts in the two-piece clamp ring for attaching the cover plate can be quickly backed out, just far enough for the clamp to clear the beveled groove in the shell flange. The clamp ring and cover plate are removed, tap bolts are backed out of the basket retaining flange and the complete basket can then be withdrawn. Spare filter baskets may be kept on hand, packed and ready for use.

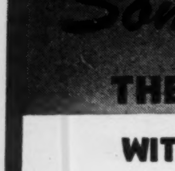
Something New in Steam Generators

THE O&S Powermaster UNIT

WITH SPEEDIER STEAMING CAPACITY

Designed for fast, efficient steam production, the new fully-automatic "Powermaster" is a complete, "packaged" unit. Compact. Lightweight. Easy to install. Easy to clean. And exceptionally speedy — developing 100 lbs. pressure from 60° water in 18 minutes or less!

Backed by more than a half-century of engineering skill and craftsmanship, the new "Powermaster" offers a new "high" in safety, cleanliness and low-cost fuel consumption. Such advantages—which resulted in its use by the Army, Navy and Pan American Airways — can be gained by plants with an AA-2 priority, or better. But in any case, investigate *now* its wide possibilities in your plant.



Get Powermaster Bulletin No. 1213 . . .

It gives you complete information on this new O & S Steam Generating Unit. Your copy will be promptly mailed, without obligation. Write now to ORR & SEMBOWER, INC., 942 MORGANTOWN ROAD, READING, PA.

10 TO 100 H. P.
OIL FIRED UNITS

ORR & SEMBOWER INC.
READING • PENNSYLVANIA
O&S
Builders of Better Boilers
Since 1885

Now is the time

1943
OCTOBER
1943
SUN MON. TUE. WED. THU. FRI. SAT.
1 2
3 4 5 6 7 8 9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24/31 25 26 27 28 29 30

to get the most out of

DUX-SULATION

DUX-SULATION
ASBESTOS PROTECTED
INSULATING FELT FOR WARM-AIR AND AIR-CONDITIONING DUCTS
DUX-SUL-GLUE

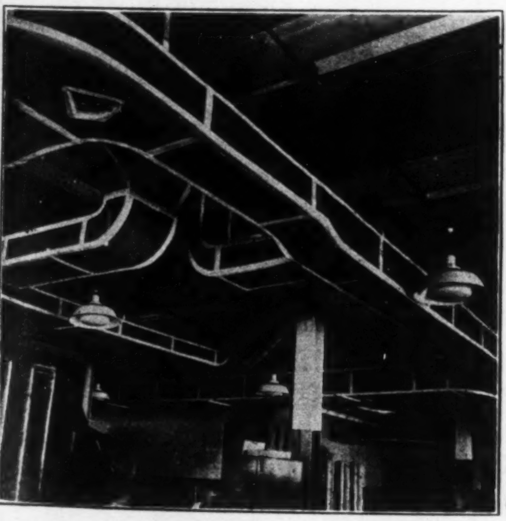
Asbestos Protected **DUX-SULATION,** the all-purpose Insulation, will not only do a man size job of ***saving fuel*** for the War effort this Winter but will automatically deaden metallic sounds and it will quiet air-borne noises.

Get the most out of your fuel and have better control of where your heat goes. **DUX-SULATION** pays for itself by making possible a more even temperature throughout the building and it prevents condensation and rust.

With **DUX-SULATION** applied to the inside or outside of your duct system, you get better heating results and quietness, too.

DUX-SULATION can easily be applied to your existing duct work without inconvenience. Requires no maintenance and lasts indefinitely.

DUX-SULATION can be given any type of surface treatment and is attractive when installed. (See photo below.)



DUX-SULATION IS a flexible insulating blanket ½′ thick having a K factor .27 B.t.u. Comes complete with corner tape and adhesive for cementing on to sheet metal duct work. DUX-SULATION comes 36″ wide in a roll containing 100 square feet. Easy to apply and a very efficient insulation against temperature losses, condensation and noise travel. Will not rot, chip or crack.

Keep top efficiency in your office, laboratory or plant throughout the heating months ahead by installing DUX-SULATION now. Order from your local Heating Supply House.

Immediate shipment in any quantity. Get the most out of your Heating System.

Write for Bulletin No. 407-H

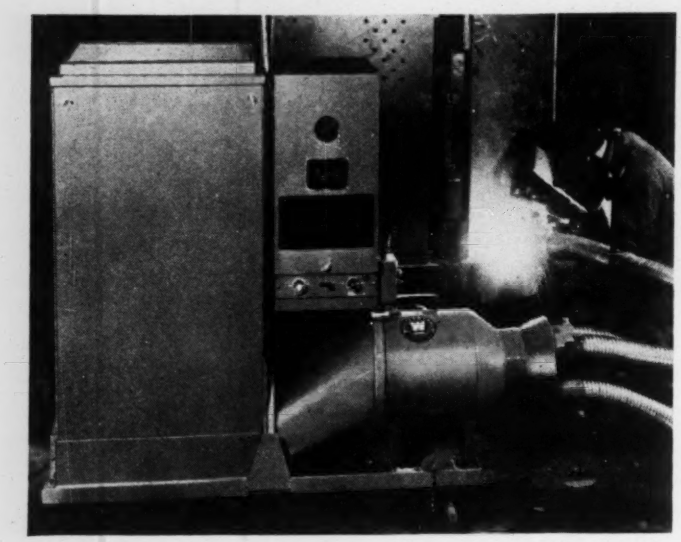
GRANT WILSON, INCORPORATED

4101 W. TAYLOR ST. CHICAGO 11, ILL.

Simplicity of construction facilitates dismantling and assembling of the various parts of the filter, says the maker. —American Locomotive Co., Alco Products Div., 30 Church St., New York, N. Y.

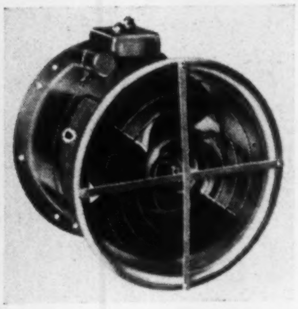
Electronic Welding Fume Remover

No. 2495*—One of the latest uses of electronics in industrial functions is for removal of welding fumes directly from the scene of welding activity. A portable "Precipitron" electrostatic air cleaning unit with three flexible metal hoses can be moved to any plant welding location. Welding fumes drawn through the hoses pass through the air cleaner, where 90 per cent of the fumes and air borne particles are removed. A potential of 13,000 volts on oppositely charged plates traps particles down to 1/250,000th of an inch in size, says the maker. The cleaned air is then returned to the room.—Westinghouse Electric & Mfg. Co., Cleveland, Ohio.



Airplane Fans

No. 2496**—Designed as a single, two blade propeller job for recirculation of cabin air through gasoline combustion heaters, for use on medium and heavy bombers and light, fast boats, the axial flow fan shown is powered with a 1/5 hp series wound 24-28 volt motor, and delivers 320 cfm standard air at sea level against 2 in. WG.



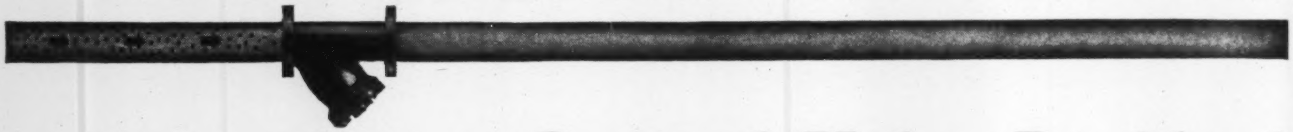
Recently the power has been increased to ½ hp and a second propeller added on a double extended shaft to handle 25 per cent more volume at double the original pressure.

Still another unit, of 7 instead of 6 in. diameter, is now in the final stages of development and will deliver approximately 600 cfm at 5 in. pressure.—Dynamic Air Engineering, Inc., 843 San Julian St., Los Angeles 14, Calif.

Connectors for Nonmetallic Ducts

No. 2497**—"Lumm" panel connectors for nonmetallic duct work represent an engineered method for assembling such ducts for heating and ventilation to conform with the restrictions now in force as to the percentage of metal that can be made available for such units, and to meet requirements for noncorrosive duct work.

Only three basic elements are required. One forms the four lineal corners of the ducts and is always used in 4 ft



Got a Control Valve Problem?

CALL ON K & M

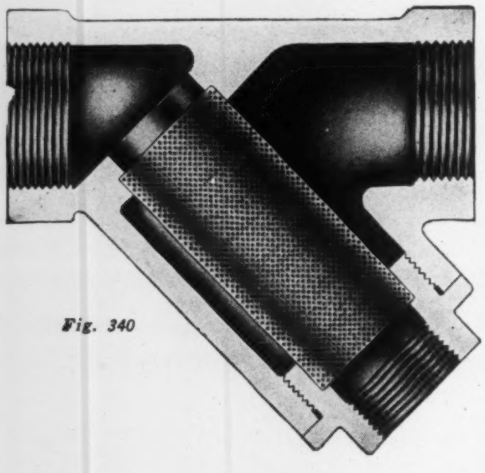


Fig. 340

War has curtailed our civilian manufacturing—and multiplied the difficulties of your job. But don't let it get you down. If you have a problem involving pressure or fluid control—an installation, operating or maintenance problem—we can save you days of work and worry. Call on our new VALVE PROBLEM CLINIC. All the know-how of 65 years of specialization is yours for the asking . . . no charge, no obligation, no red tape. Whether or not you are using K & M equipment . . . we invite you to *call on K & M.*

K & M SIMPLES PRESSURE REDUCING VALVE, particularly applicable in reducing water main pressure to protect fixtures in residential or industrial service . . . or for other water, air, gas or cool oil service where space limitation is a factor and initial pressure is 150 lbs. or less. Sizes ½" to 2"—with traditional K & M efficient design and rugged construction.

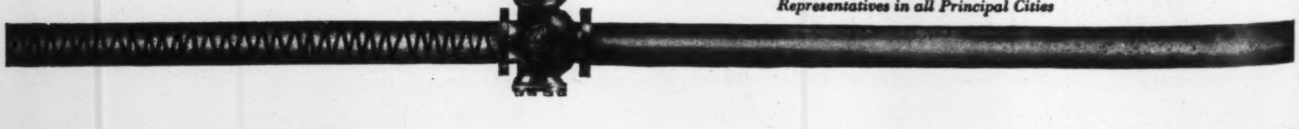
KM KIELEY MUELLER ESTABLISHED 1879

Kieley & Mueller

ENGINEERED PRESSURE & FLUID CONTROL SPECIALTIES

NORTH BERGEN, NEW JERSEY

Representatives in all Principal Cities



TIME
WILL
TELL

When the war is over the performance of shop equipment under emergency pressure will be critically examined and analyzed. That process will reveal anew the true worth of Watson-Stillman Forged Steel Fittings, Valves and Hydraulic Machinery, always designed and built to withstand time and the ravages of constant use under strain. The Watson-Stillman Co., Roselle, N. J.

FACTS IN PRINT — In a series of five Booklets, covering as many Watson-Stillman products, a comprehensive and factual description of each is given. A copy of any that will serve you may be had on request.

VICTORY
BUY
UNITED STATES
WAR
BONDS
AND
STAMPS
Bonds
BUY
Bombs

WATSON-STILLMAN

Distributor Products Division

Engineers and Manufacturers of Forged Steel Fittings and Valves, Hydraulic Machinery and Equipment, Hydraulic Presses, Pumps and Jacks.

4734

lengths or portions thereof. Another member is used to form a flange frame for one end of each duct section and a third is used to form a frame for the opposite end. One frame is then bent over the flange of the other frame, providing a standing seam all the way around the duct.

These three basic members come in various gages of metal depending on the perimeter of the duct required. The clips are placed on 12 in. centers and are so shaped as to permit the nonmetallic panels to be fitted snugly between them and the member.—A. H. Lumm Co., Toledo, Ohio. Distributed by Dravo Corp., Neville Island, Pittsburgh, Pa.

Pulsation Dampener

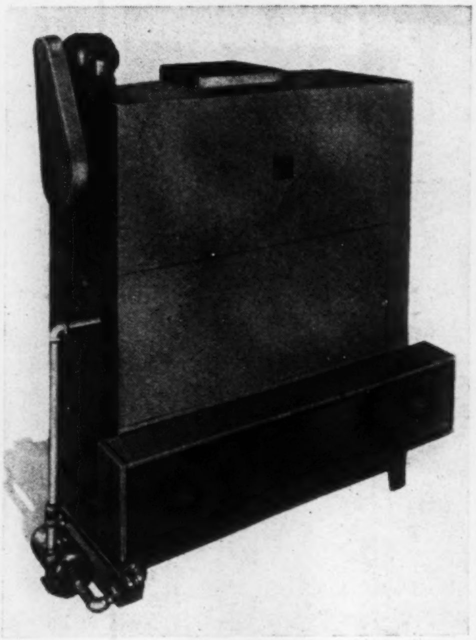
No. 2498—A new pulsation dampener for use with pressure gages subject to severe pressure pulsations and rapid fluctuations, such as on reciprocating pumps, is good for all pressures up to 5000 psi and for any pressure medium such as air, water, oil, or steam, whenever a dampening device is needed.

The principle is simple, yet ingenious. A small monel plunger oscillates freely in a cylindrical hole in the bushing. The clearance between the plunger and hole is just sufficient to give the proper throttling action for certain conditions. The free movement of the plunger makes the device self cleaning.

Since no throttling device is effective under all conditions (such as scope and rapidity of pressure fluctuations, and viscosity of pressure medium), five different size holes are provided in the bushing. The plunger may easily be transferred from one hole to another, depending upon the degree of dampening required. All holes are sealed off, except the one in use, by means of the sealing disc.—Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Evaporative Condensers With Builtin Filters

No. 2499—Evaporative condensers with builtin air filters to protect against impurities in the cooling system are now available in the new "Wat-R-Miser" line. These units effect heat transfer by means of water evaporation in a continuously moving air stream. They are adaptable to a wide variety of industrial applications such as cooling batch quenching fluids, cooling oil for large diesels, cooling jacket water, etc., says the maker, who points out that proper filtering of the air eliminates or greatly reduces four important upkeep problems — clogging of lines due to impurities in the system, plugged spray nozzles, excessive head pressures, and pump maintenance.



The new air filter feature is standard equipment on all models, from capacities of five to 100 tons.—Drayer & Hanson, Inc., 738 E. Pico Blvd., Los Angeles 21, Calif.

Plastic Protective Coating

No. 2500—Further evidence of the widening range of application of plastics is seen in the announcement of the

GEROTOR
TYPE OHM
DOUBLE HAND HYDRAULIC PUMP
TANKER
Used in Marine Service for
(1) Emergency Hydraulic Steering
(2) As a Rudder Brake
(3) For Filling and Draining Rams
SPECIAL FEATURES—(1) REVERSIBLE (2) ANTI KICK-BACK
G.P.M. 2½ P.S.I. 450 R.P.M. 35
Another example of
GEROTOR'S SERVICE
TO UNCLE SAM
GEROTOR MAY DIVISION
MAY OIL BURNER CORPORATION BALTIMORE MD

Another example of GEROTOR service to Uncle Sam

When the war is won GEROTOR will again continue to play a vital part — *in your business* — selling more Quiet May Oil Burners for you! May Oil Burner Corporation, Baltimore, Maryland.

QUIET MAY OIL BURNERS

LOOKING FOR BUSINESS?
. . . LOOK TO STEEL

YOU sheet metal specialists don't necessarily have to wait for war's-end business. Right now there is plenty of essential war work to be done in many localities. There are other jobs as well—in schools, hospitals and institutions, for instance.

There is business for you wherever essential ductwork, roofing, siding and partitions have to be installed, altered or repaired. How do we know? Because everyday requirements for plant maintenance, alterations and expansion maintain a steady demand for U·S·S Steel Sheets.

Doubtless you are keeping in touch with advanced shop methods, improved welding technique, better joint designs—increasing your skill in cutting, shaping and fabricating sheet steel. But, do you also recognize the unique characteristics of each type of steel, appreciate the importance of its beauty, lightness—resistance to heat, abrasion, impact and corrosion — its wide range of workability? That is the way to insure—for your present activities and future plans—full benefit from the demand for products made of U·S·S Steel Sheets.

Our technical staff is always available for consultation on your individual difficulties. Also, to help you toward better knowledge of our steels, we offer invaluable practical data, solutions to many of your pressing problems, in the U·S·S Sheet Metal Worker's Guide. Send for your free copy.

U·S·S STEELS FOR SUCCESSFUL SHEET METAL WORKMANSHIP

U·S·S GALVANIZED STEEL for sheet metal structures requiring the added protection of a zinc coating.

U·S·S COPPER STEEL to give twice the atmospheric corrosion resistance of regular steel at little additional cost.

U·S·S PAINTBOND—A galvanized, Bonderized sheet that permits immediate painting and holds paint tighter. U·S·S Dul-Kote, a product with similar qualities, available in the South and West.

U·S·S HOT-ROLLED AND COLD-ROLLED STEEL to provide the basic advantages of steel, plus maximum economy, in accordance with the needs of each individual job.

U·S·S STAINLESS AND HEAT-RESISTING STEELS to assure high resistance to corrosion and heat, and to reduce weight.

U·S·S VITRENAMEL — Sheets designed especially for porcelain enameling.

U·S·S LOW-ALLOY, HIGH-TENSILE STEELS to resist corrosion and increase strength-weight ratio.

U·S·S STEEL SHEETS

CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
United States Steel Supply Company, Chicago, *Warehouse Distributors*
United States Steel Export Company, New York

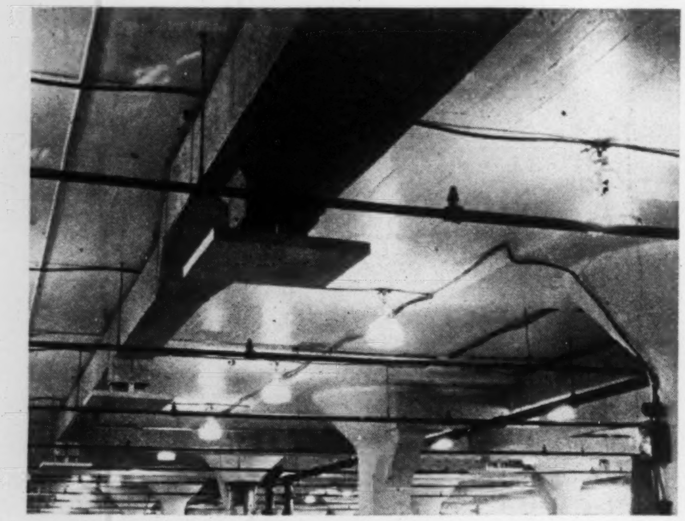
UNITED STATES STEEL

development and use of a new plastic protective coating known as "Plast-Anneal" by a firm of ventilation engineers and manufacturers of ventilating equipment.

This material is applied after fabrication, thus covering and protecting all surfaces and interstices of the various ventilating units built by the company. An advantage is that the basic formula can be altered to produce an adequate protection for almost any requirement where atmospheric conditions present known concentrations of acid or alkaline solutions; the plastic coating can thus be tailor made for the job.—Allen Corp., 9767 Erwin Ave., Detroit, Mich.

Asbestos Board Ducts

No. 2501—Through the use of "Ruberoid" asbestos board duct work, engineers of Carrier Corp. were able to save a total of 78,000 lb of steel in a recent installation of ventilating and air conditioning equipment in a plant of the United States Rubber Co.



Sixteen heat diffusers were provided to supply 100 per cent outside air for spaces with high concentration of ethylene dichloride, methyl ethyl, ketone, and isopropyl alcohol. Twenty-one ventilating units for exhaust air purposes were also installed. Along with these there were three industrial air conditioners with cooling coils for the circulation of well water. This air conditioning equipment is for use in the processing of rubber for self-sealing airplane fuel cell tanks in connection with nylon and cement drying. As nylon is applied with paint brushes, the volatiles within it flash off, causing a low surface temperature which would result in "blushing" if surrounding air were not reduced in dew point to a satisfactory low level around 55 F.

There is also a spray washer for cooling and ventilating in connection with the processing of rubber for raincoats. Heating coils were installed in the same plant for use in the drying process. Because there are concentrated vapors in the room where the rubber is cemented to the fabric, ventilation for employee health and comfort is necessary.

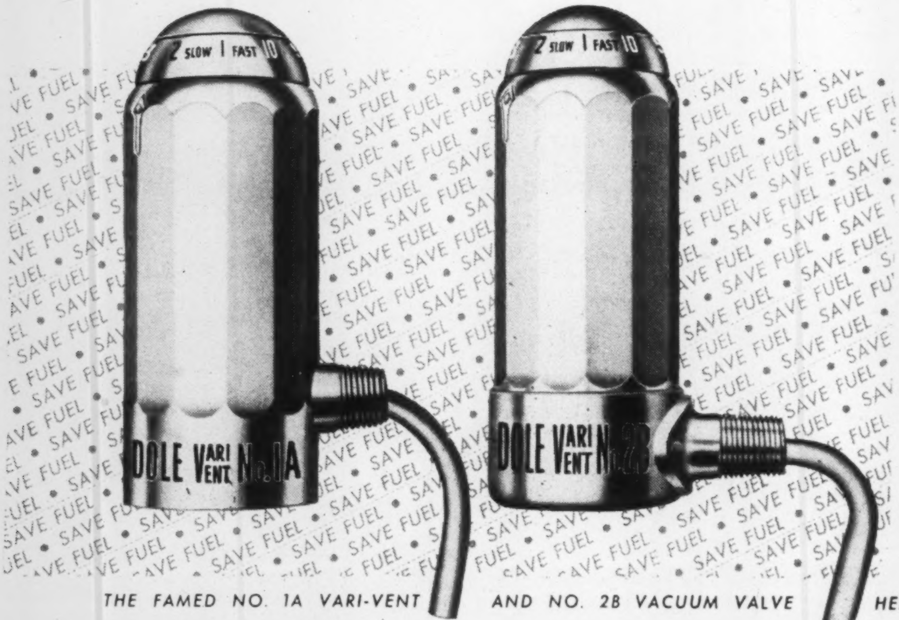
All duct work is made of asbestos board. Even the ejector nozzles in the industrial air conditioners were made of asbestos board instead of the usual brass.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Positive Bearing Lubrication

No. 2502—Positive lubrication of all bearings on machine tools and similar equipment, regardless of location or condition of bearings, can be had through the improved "Multival" system, says the manufacturer. Oil or grease under pressure is delivered to the distributing blocks by means of a manual or power operated portable gun which serves as a central pump.

The complete equipment consists of the multiple valve blocks, each serving two to 10 bearings, lubricant lines leading to individual points, and suitable fittings to accommodate practically any type of bearing connection.—Farval Corp., 3249 E. 80th St., Cleveland, Ohio.

Back in Time to Help Save Fuel



● Dole Valves are now coming through in increasing volume!

Production had been virtually stopped by the Government's need for our materials and precision-trained workers—diverted at a critical stage of the fight to production of vital war needs.

Now the shifting picture finds the *fuel* situation critical on the home front. Dole Air and Vacuum Valves—one of the simplest replacements which promote fuel conservation—are again available with no change whatever in their vital working parts. New plant capacity has been provided to supply you without letting up on war production.

THE FAMED NO. 1A VARI-VENT AND NO. 2B VACUUM VALVE HEAD UP THE LINE

NOW BEING SHIPPED

DOLE *Air and Vacuum Valves*

THE DOLE VALVE COMPANY
1901-1941 Carroll Ave., Chicago 12, Illinois
OFFICES AND REPRESENTATIVES IN PRINCIPAL CITIES

Now—You Can Get that LINK-BELT Stoker—

if you burn a minimum of 40 tons of bituminous or anthracite coal per year

Open Hopper Industrial Unit
Closed Hopper Commercial Unit
LINK-BELT STOKER

Now— you can profit by the fuel savings a Link-Belt Stoker makes possible over hand firing.

Now— an industrial or commercial Link-Belt automatic Stoker can be yours if you act quickly.

Now— get in touch with the nearest Link-Belt Stoker dealer today or write, wire or phone—

LINK-BELT COMPANY
Mfg. Plant and Sales Hdqrs: 2410 W. 18th St., Chicago 8, Ill.
Eastern Sales Hdqrs: 420 Lexington Ave., New York 17, N.Y.

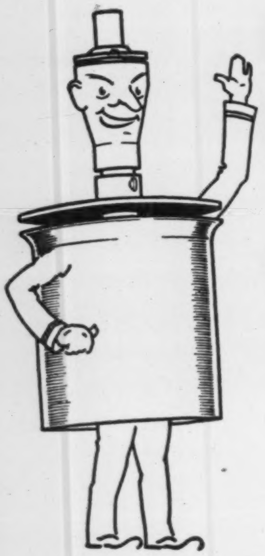
9320

ARMY E NAVY
For Excellence In War Production

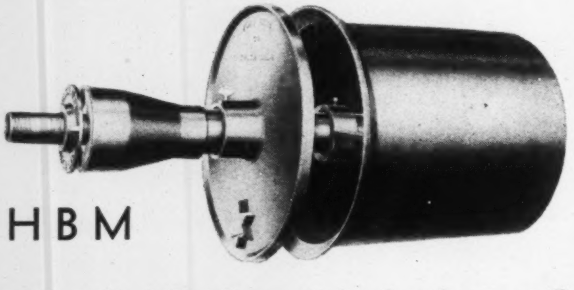
LINK-BELT
AUTOMATIC COAL STOKERS

SAVE
Fuel, Labor and Transportation

You Name the HEAT PATTERN we'll Produce it



We feel sure that this John Zink Burner will fire a furnace to a higher rating than any other type of burner made, and still maintain even heat distribution.



HBM

Also that the HBM Burner is by far the most flexible burner ever made, as just about any type of heat pattern can be produced — Heat in front of the furnace — Heat in back of the furnace — Heat in center of the furnace OR uniform heat can be produced throughout the furnace.

This burner will burn anything that can come through a gas line—not damaged by slugs of water, gasoline or oil sometimes present in the fuel line.

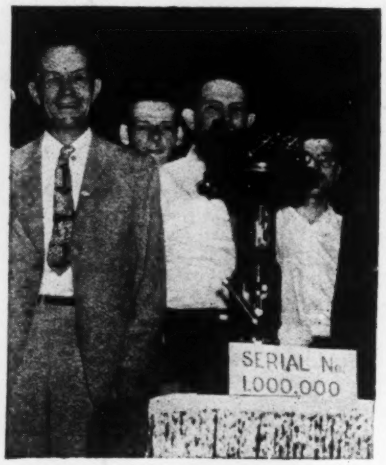
Write for Details Now!

John Zink Co.

TULSA, OKLAHOMA

New York • Los Angeles • Detroit • San Francisco

Automatic Controllers



No. 2503—Typical of the hundreds of thousands of the manufacturer's automatic controllers that are serving critical war industries is this "Type 435T" controller, serial No. 1,000,000, recently installed in a new aviation gasoline plant.

The 1,000,000th controller was unveiled at a Coca-Cola spotlight band blue network broadcast on July 14. N. T. Chadderdon, president, with other employees is pictured.—Fisher Governor Co., 205 S. First Ave., Marshalltown, Ia.

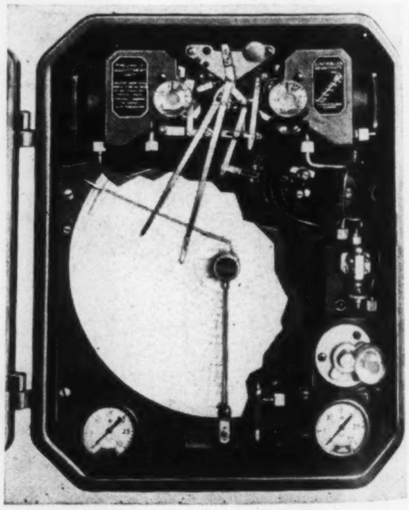
Industrial Thermometers

No. 2504—A new industrial thermometer with a plastic case front, a yellow background, easy reading thermometer tubing, and a malleable iron back, was recently announced. According to the manufacturer, the plastic case front reduces the weight and conserves metal. It is also stated that the plastic is not affected by temperatures to which the case is subjected under actual service conditions.

The yellow back lens front thermometer tubing "offers excellent color contrast with the mercury." The tubing also is comparatively easy to produce and does not involve complicated construction of bore or lens.

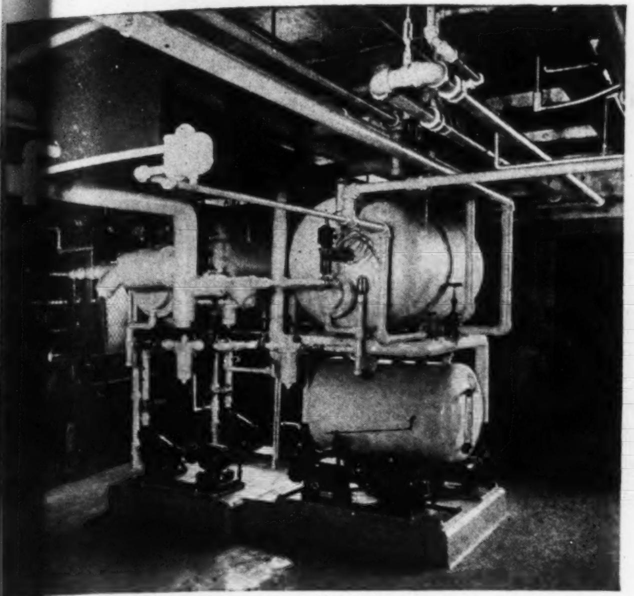
The manufacturer states that malleable iron has been found to be an entirely satisfactory substitute for the brass formerly used, and is fully protected against corrosion by a durable black finish.—C. J. Tagliabue Mfg. Co., 540 Park Ave., Brooklyn, N. Y.

Pneumatic Set Controller



No. 2505—To meet demand for a controller whose control point, as indicated by a set pointer, would be automatically adjusted by variations in output air pressure from another remotely located instrument, the pneumatic set controller illustrated was developed in both indicating and recording forms. The remotely located instrument may be an indicator, recorder, or controller.

This device is fundamentally a "Fulscope" controller with an additional unit to convert changes in input air pressure into linear movements of the set pointer. The magnitude of the linear set pointer movement per pound change



Power Plant Installation of Two Patterson Hot Water Storage Heaters

Peacetime Equipment
DESIGNED TO
Outlast the War

by PATTERSON-KELLEY

In power plants and war industries . . . on shipboard and in shipyards . . . in army camps and at advanced military bases, Patterson Hot Water Storage Heaters are "on active duty!" Many of them were installed before Pearl Harbor. And because these Patterson hot water storage units were constructed of durable materials, according to exacting specifications, they are giving a good account of themselves — supplying hot water *when* it is needed, *where* it is needed and in the *quantities* needed.

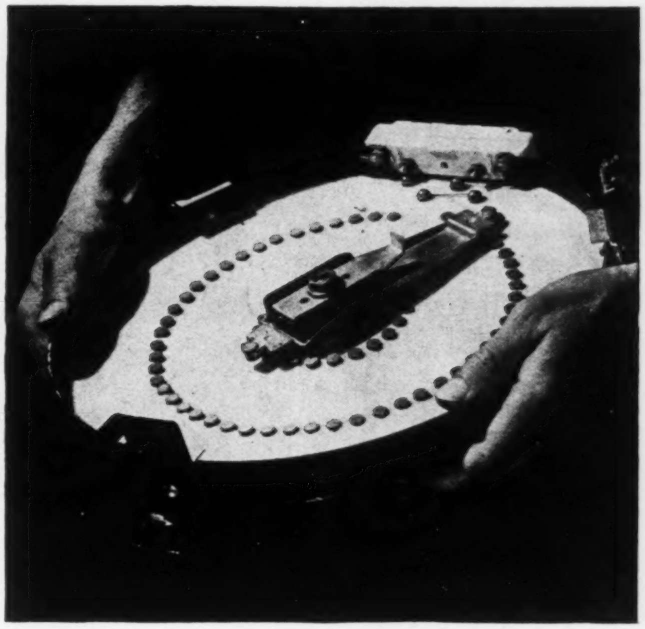
Today, as in the past, Patterson-Kelley is building all types of heat exchange equipment — subject, of course, to W.P.B. allocations of strategic metals. If your preference rating — or that of your clients — does not entitle you to a new Patterson Hot Water Storage Heater, *extra* care must be taken to insure maximum, trouble-free service from existing equipment. And that is where Patterson-Kelley *can* help you — *today*. Our engineers are available to you for free consultation on the care and conservation of all hot water installations. Why not drop us a line today?

EST. 1880

PATTERSON-KELLEY HEAT EXCHANGE ENGINEERS

PATTERSON-KELLEY *FOR DEPENDABLE ECONOMICAL SERVICE*

THE **Patterson-Kelley** CO., INC.
107 WARREN ST., EAST STROUDSBURG, PA.



IT'S SUBSTANTIAL

A Rheostat is a piece of equipment where substance and quality spell real economy. A good Rheostat properly installed and used will outlast the machine it controls. It is wise, therefore to use the best Rheostat obtainable.

Ward Leonard Pressed Steel Rheostats are built on that premise. They are absolutely smooth in operation due to proper design and fine machining. They dissipate heat from both sides keeping temperatures low. Contacts are round or rectangular solid metal ground for perfect fit. These are but a few of their many advantages.

Bulletin 60 gives full particulars. Send for a copy.

ARMY E NAVY
ARMY E NAVY

Pressed Steel Rheostats are made in 4" to 18", Ring types from 1½" to 4", incl.

WARD LEONARD
RELAYS • RESISTORS • RHEOSTATS

Electric control* WL *devices since 1892.

WARD LEONARD ELECTRIC COMPANY
31 SOUTH STREET, MOUNT VERNON, N. Y.

Mortite UTILITY TAPE

HUNDREDS OF USES

★

INSULATES • WEATHERSTRIPS
PLUGS UP CRACKS • MAKES PACKING
OR GASKETS • CAULKS CASEMENTS
GLAZES WINDOWS

This new pliable plastic does not crack, chip, dry out or shrink. Easy-to-handle, unrolls like ribbon and is ready for use, inside or outside. Can be painted.

SIMPLE TO APPLY

Mortite adheres to any clean, dry surface. No tacking or tools needed, just press into place and it stays put.

About 80 ft. to a box. Order through your supply house or $1.25 postpaid. ($1.40 west of Rockies.)

Circular Free

J. W. MORTELL CO.
512 BURCH ST.
KANKAKEE, ILLINOIS

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

NoDrip A SURE CURE

• This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition surfaces. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance. A gallon covers about 30 feet of ½" pipe. Dries in 24 hours. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House.

FREE *NoDrip Circular about Condensation Drip and its Prevention.*

APPLY WITH BRUSH, TROWEL OR SPRAY

J. W. MORTELL CO.
Technical Coatings Since 1895
512 BURCH ST. KANKAKEE, ILL.

in input air pressure is governed by the setting of the adjustment dial. The unit also provides for set pointer adjustments in either direction for an increase in input air pressure, and for limiting the travel of the set pointer within given limits. There is also a manual set pointer adjustment feature.

This pneumatic set controller has a number of applications. In the production of synthetic rubber, for example, it is being used to control the jacket water temperatures of reactors to maintain constant product temperature. It is also used to control the speed of internal combustion engine driven air compressors to maintain constant suction or discharge pressures.

In air conditioning work, pneumatic set "makes it possible to keep a fixed temperature ratio between outdoors and indoors, thus eliminating shock experienced when there is too great a variation between the two."—Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.

Flexible Fastener for Tubing

No. 2506—A new device, known as the "Packless" flexible fastener, combines the functions of a supporting strap and a vibration absorber for stationary or movable tubing. It was developed at the request of aircraft builders who desired a simplified and improved hose strap that would eliminate the whip of hose in airplane engines. It is believed to have numerous applications in the refrigeration, railway, and other fields.

The device consists of a sensitive spring, cone spiraled, and terminating in a clip which snaps on the tube or other unit to be fastened. The fastener is fixed to a supporting surface by means of a standard or wood screw fitted through the cone. Inasmuch as it flexes in all directions, the fastener can be installed in either lateral or vertical positions.

According to the manufacturer, the free action of this fastener in all directions prevents—when used with copper tubing—the crystallizing of the copper such as is induced by rigid straps which prevent expansion and contraction and concentrate stresses near the couplings.—Packless Metal Products Corp., 31 Winthrop Ave., New Rochelle, N. Y.

Cylinder Pressure Regulator

No. 2507—A new pressure reducing regulator designed particularly for the purpose of refilling to 400 and 800 psi. smaller cylinders from cylinder manifold systems, has a number of advantages, according to the manufacturer. With improved pressure accuracy, it has a specially designed diaphragm which is gas loaded instead of spring loaded and so constructed that damage to or rupture of the diaphragm is "virtually impossible."

SOMETIME (SOON?)

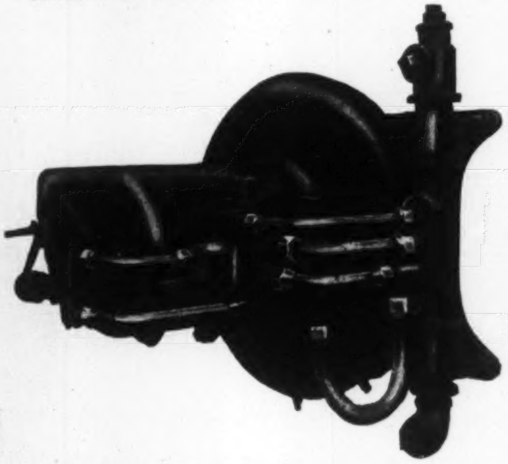
PETRO

REG. U. S. PAT. OFF

OIL BURNING SYSTEMS

will be available once more for normal business.

Their "Oil Miser" economy will contribute much to post-war efficient operation at low cost.



Automatic, semi-automatic or manual operation using No. 5 (or lighter) oil —or No. 6 (Bunker "C") oils, preheated. Capacities to 145 gallons per hour. 487 boiler H. P.—68,000 sq. ft. steam.

Even war-time research has not discovered any method of heavy oil combustion that equals or improves Petro's Thermal Viscosity principle of automatic firing at constant efficiency.

As a principle of design and operation, rather than a mechanical part, it can't wear out or break down. It cuts "service" as well as operating supervision.

Petro Engineers are working on post-war plans with a lot of Contractors. Can they help you?

OIL IS AMMUNITION USE IT WISELY

Full data on Petro Industrial Burners are in our Catalog—see Sweet's or Domestic Engineering Catalog Files—or we will gladly send copies on request.

PETROLEUM HEAT AND POWER COMPANY

Makers of Good Oil Burning Equipment Since 1903

STAMFORD CONNECTICUT

FOR VERTICAL DELIVERY

AIRTHERM
AIRTHERM

FOR HORIZONTAL DELIVERY

AIRTHERM
UNIT HEATERS

Now—more than ever—sturdy construction counts

To insure maximum heat and usage, all Airtherm Unit Heaters have these features:

Extra-heavy tube-wall thickness of .065." Ingot iron tubes.

Lead-alloy coated condensers for greatest possible protection from corrosion.

Condensers guaranteed to withstand steam pressure up to 150 lbs. per sq. in.

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. ST. LOUIS 10, MO.

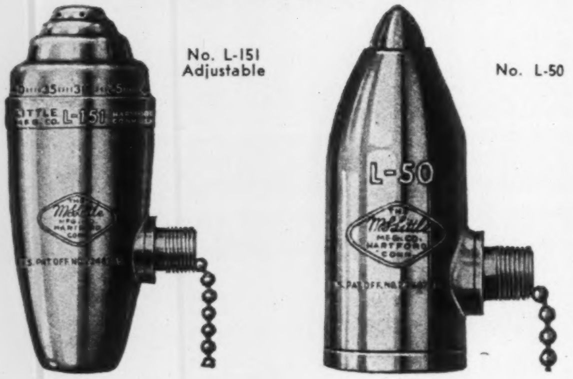
Now Available!

M. S. LITTLE RADIATOR AIR VALVES

EXCLUSIVE FEATURE
PATENTED PRINCIPLE
"DROP-BY-DROP" DRAINAGE

U. S. Pat. No. 2246765
FLEXIBLE SYPHON

BEADED CHAIN-DRAIN



M. S. LITTLE Radiator Air Valves are now available in Adjustable and Non-Adjustable Types . . . Each has the Patented FLEXIBLE SYPHON "Drop-By-Drop" positive drainage principle . . . More efficient performance, under all conditions, than from the ordinary syphon tube method . . . FLEXIBLE SYPHON Radiator Air Valves *do* save fuel!

THE WAR PRODUCTION BOARD recognizes the importance of fuel saving Radiator Air Valves to this year's Fuel Conservation Program . . . Materials allotted to The M. S. LITTLE MFG. CO. make it possible to manufacture No. L-151 and No. L-50 to the same materials specifications used prior to the war.

Yes, M. S. LITTLE Radiator Air Valves, with the FLEXIBLE SYPHON feature, are *FUEL SAVERS!*

Attractive, colorful FOLDER describing the line available on request.

MADE BY M S Little
TUBULAR BRASS PLUMBING GOODS
HEATING SPECIALTIES
THE M. S. LITTLE MFG CO HARTFORD, CONN U. S. A.

The loading pressure of the main regulator is controlled by a built in pilot regulator, tension screw of which is so arranged that it will not permit a diaphragm loading pressure beyond a predetermined maximum.—Victor Equipment Co., 844-54 Folsom St., San Francisco, Calif.

Low Temperature Blood Desiccating Machine

No. 2508—A new development in the field of low temperature was recently announced—a refrigeration machine designed for desiccating blood plasma serums and water soluble medicaments. The first of these machines, in operation at a large pharmaceutical manufacturing plant, has capacity to desiccate 36 bottles at one time.

Among the features of these machines, says the manufacturer, is the inherent temperature control utilizing the expansion and construction of the chilling chamber itself in connection with a microswitch to secure infinitely variable temperature control. Other features include a "super heat suppressor" and an efficient oil separator to remove the oil from the refrigerant and put it back in the compressor. Another development is a special valve that makes possible the proper functioning of these low temperature refrigerating machines.

In addition to desiccating equipment, the manufacturer builds a line of industrial chilling machines for the shrinking, testing, hardening, and stabilization of metals. Most widely used of the units is one for temperatures ranging down to 120 F below zero with a heat absorbing capacity of 1000 Btu per hr at —120 F.—Deepfreeze Div., Motor Products Corp., 2301 Davis St., North Chicago, Ill.

Indoor Climate Institute Is Formally Organized

At a meeting in Cleveland September 14, the Indoor Climate Institute was formally organized by leading manufacturers in the heating, cooling, and equipment industries. The institute has, as its primary purpose, a program for "the improvement of heating and air conditioning in the interests of public health and greater indoor comfort."

The institute, a nonprofit corporation, will have its headquarters in Detroit. It will serve as a clearing house of information, set up with a central staff and committees qualified to conduct a broad program of public and trade education. The public will be informed as to the many benefits in health, comfort, and economy resulting from properly designed and installed prime heating equipment—burning coal, gas, or oil for warm air, hot water, or steam heat.

With the inevitable postwar demands for summer cooling, as well as greater heating efficiency and comfort in winter, the program of education will aim to clarify conceptions as to systems and methods which will assure truly air conditioned or cooled areas in homes, commercial establishments, offices, public buildings, and industrial plants.

The Indoor Climate Institute proposes the establishment of local chapters throughout the country, with membership in the local organizations to be composed of the various members of the trade, dealers, and utility companies.

A number of objectives have been set up for the first year of operation for the institute. A comprehensive study of manpower problems, now and for the postwar period, is to be made. This will assist everyone in the heating and cooling industries to recruit and train personnel in the many specialized skills required in the manufacture, distribution, and installation of central heating and cooling systems. Technical committees have been set up to study the codes, standards and practices, as established by the various industry trade associations and authorities for the benefit of the public.

Officials of the ICI state, "Next to food, heat has become the most important subject affecting the health of America. The need of fuel conservation and proper indoor climate to preserve the health of the nation offers the institute an

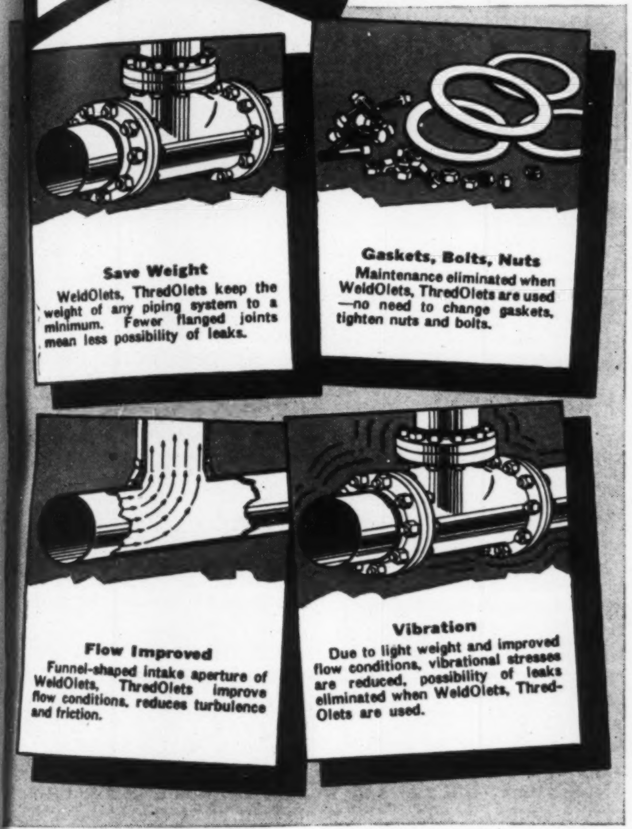
Make Good Piping Better with WELDOLETS · THREDOLETS

3 Types Meet Every Need

WeldOlets for butt welded branch connections.

ThredOlets for screwed branch connections.

Socket-End WeldOlets for socket-type welded branch connections.



Save Weight
WeldOlets, ThredOlets keep the weight of any piping system to a minimum. Fewer flanged joints mean less possibility of leaks.

Gaskets, Bolts, Nuts
Maintenance eliminated when WeldOlets, ThredOlets are used—no need to change gaskets, tighten nuts and bolts.

Flow Improved
Funnel-shaped intake aperture of WeldOlets, ThredOlets improve flow conditions, reduces turbulence and friction.

Vibration
Due to light weight and improved flow conditions, vibrational stresses are reduced, possibility of leaks eliminated when WeldOlets, ThredOlets are used.

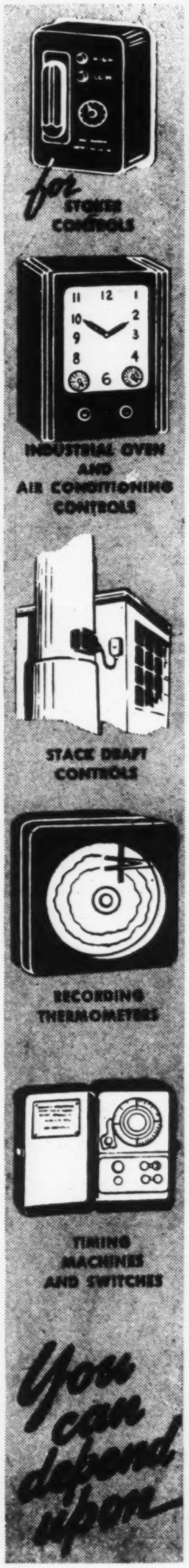
WeldOlets, ThredOlets and Socket-End WeldOlets are suitable for all commonly used pressures and temperatures in every type of piping system. They are installed either before or after erection of the main line—and always with ease and economy. They are equally well adapted to pre-fabricated or "on-the-job" assemblies. Stocked for all standard pipe sizes up to 12" in size-to-size and reducing sizes—and can be supplied on special order for pipe up to 24". Stock fittings are drop forged steel, but to meet special conditions will be supplied in Monel, Everdur, Toncan Iron, wrought iron, etc.

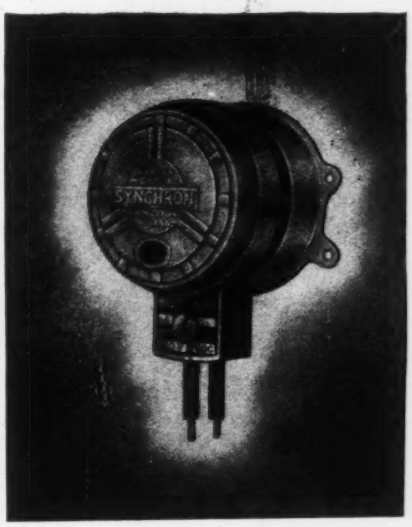
Bulletin WT31 gives detailed information about all the advantages of WeldOlets, ThredOlets and Socket-End WeldOlets. Write for your copy today.

Forged Fittings Division
BONNEY FORGE & TOOL WORKS
ALLENTOWN, PA.

Star Awarded
July 10, 1943

WELDOLETS · THREDOLETS
Welded Outlets for Every Piping System





For War or Peace-time Production, this tiny SYNCHRON "600" Will Save You Money

Save you money—because once it leaves your factory, SYNCHRON never returns for costly repair or replacement! Hundreds of thousands of these miniature, synchronous, self-starting motors have a proven record of economy over years of continuous operation.

Small—but Powerful!

Only 2¾" in diameter by 1 5/16" deep, this compact little motor pulls up to 8 oz. direct load continuously at 1RPM. Brass gears, hardened steel shafts, steel pinions, oil-impregnated double bearings provide lasting power transmission.

Any Speed You Need—

Made in standard speeds from 1 to 300 RPM, clockwise or counter-clockwise, in all voltages and cycles. Other speeds to meet special requirements.

Lifetime Lubrication

SYNCHRON "600" Timing Motors never need oiling. In addition to oil-impregnated bearings, a sealed-in supply of special oil surrounds all moving parts. SYNCHRON operates at temperatures 40 degrees below zero to 140 above.

Serving Uncle Sam—and You

Special assignments for the Army Air Forces and the Navy are keeping us busy—but we have expanded our facilities and can probably make deliveries to you when you need them. Write for the new SYNCHRON Catalog.

SYNCHRON
600
Tiny Timer

HANSEN MANUFACTURING CO., INC.
PRINCETON 6, INDIANA

SYNCHRON
TIMING MOTORS—TIME MACHINES

Chase away the
"WOBBLIES"

with the
New
BEAR
DY-NAMIC BALANCING

Chase away
Excessive Wear
Vibration
Noise
caused by
Couple-Force Action

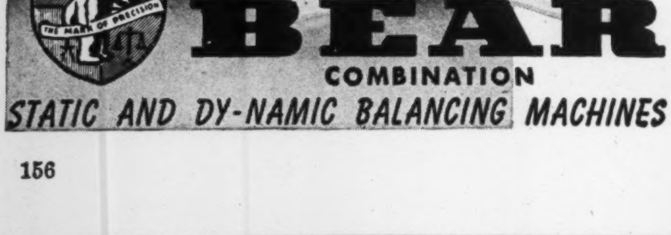
No longer is it a difficult, tedious, costly process to chase these destructive "Wobblies" of Dy-Namic Unbalance out of Armatures, Flywheels, Fans, Crankshafts, Blowers, and other rotating parts.

BEAR has introduced entirely New Dy-Namic Balancing machines—based on a totally different, but proven, principle —that makes Dy-Namic Balancing faster . . . lower cost . . . easier . . . requiring no skilled technicians.

Manufacturers, large and small, report that this new, Bear Dy-Namic Balancing has two great fields of usefulness:-

1. **On Products Manufactured**—Dy-Namic Balancing of rotating parts prevents premature wearing out; insures smoother, quieter operation and longer life.
2. **On Own Production Machinery**—Bear Dy-Namic Balancing lessens need for frequent adjustment and repairs; eliminates costly power waste.

WRITE FOR FREE DATA BOOK showing the many types, sizes and models of Bear Dy-Namic Balancing Machines available to those with war industry priorities. Address Bear Mfg. Co., Industrial Division, Dept. HPV, Rock Island, Illinois.



BEAR
COMBINATION
STATIC AND DY-NAMIC BALANCING MACHINES

opportunity to make a real contribution. Automatic control of temperature and humidity is going to provide an entirely new conception of indoor comfort for Americans in the postwar period. Heating and cooling equipment will be as advanced in design, construction, and performance as the products of other great industries. It will reflect the progress made and lessons learned in meeting the demands of war production."

The board of directors and officers of the ICI are launching a membership drive immediately. The executive personnel has been elected, as follows: *Officers—President*, Paul B. Zimmerman, Airtemp Div., Chrysler Corp.; *First Vice-President*, T. A. Crawford, Timken Silent Automatic Div.; *Second Vice-President*, E. N. Hunter, National Radiator Co.; *Secretary*, R. E. Moore, Bell & Gossett Co.; *Treasurer*, E. N. McDonnell, McDonnell & Miller.

The officers and the following compose the board of directors: A. T. Atwell, Quaker Mfg. Corp.; C. T. Burg, Iron Fireman Mfg. Co.; W. J. Grover, Surface Combustion Corp.; John Knighton, Servel, Inc.; C. D. Lyford, Minneapolis-Honeywell Regulator Co.; J. M. McClintock, Illinois Iron & Bolt Co.; John Rainbault, General Electric Co.; J. R. Scott, Mueller Furnace Co.; Jack Searls, White-Rodgers Electric Co.; and W. L. Seelbach, Forest City Foundries Co.

The advisory council to the board is composed of Homer Addams, Fitzgibbons Boiler Co., Inc.; Lyle C. Harvey, Bryant Heater Co.; Carroll E. Lewis, Delco Appliance Div., General Motors Corp.; W. L. McGrath, Williamson Heater Co.; Albert Penn, Penn Electric Switch Co.; L. R. Ruthenberg, Servel, Inc.; E. C. Sammons, Iron Fireman Mfg. Co.; and Arthur Schellenberg, Alco Valve Co.

Although it is not contemplated that there will be any advertising conducted by the ICI until the postwar period, all members will be furnished with the insignia which will appear in their individual advertising.

◆

Air Conditioning Used in Processing Human Serum Albumin

How the Upjohn Co., a leading manufacturer of pharmaceuticals, utilizes air conditioning and refrigeration equipment in processing human serum albumin was described recently by E. T. Murphy, senior vice president, Carrier Corp.

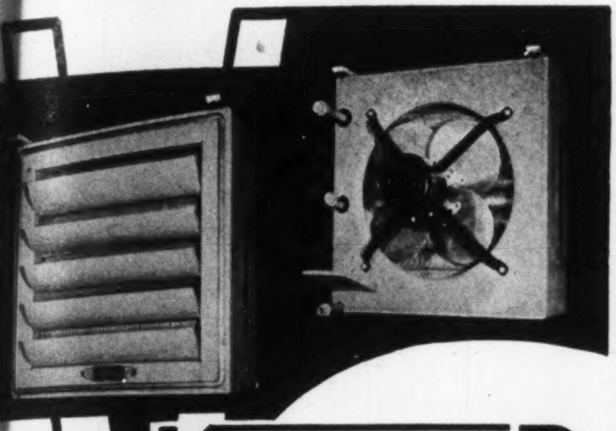
Human serum albumin differs from dried blood plasma in that it is ready for immediate injection into the patient, whereas dried plasma must be put into solution with distilled water before the transfusion can be made. It differs also in that plasma contains all of the elements of human blood except the red and white cells, while in the case of serum albumin all of the constituents of the blood except the albumin have been removed. The shipping bulk is about one-tenth of that required for an equivalent of plasma.

The human blood is received from the Red Cross bleeding centers in ice-cooled shipping containers and is at once stored in a room kept at 34 F by means of a refrigerating machine and cold diffuser. The red and white cells are separated by means of centrifugals, and the clear plasma is siphoned off under aseptic conditions.

Further operations on the plasma are carried out in a room held at 23 F by means of air conditioning. The process consists in precipitating and separating one by one the various constituents of the blood. This is accomplished by controlling three factors, the temperature of the solution, its hydrogen ion concentration, and the concentration of the alcohol which is added. In this way the fibrinogen and the various globulin fractions are precipitated and separated and finally the pure albumin is precipitated.

The alcohol is removed by shell freezing the albumin solution and drying under a high vacuum. The dried albumin is dissolved in sterile water to give a 25 per cent solution. Air conditioning equipment serves during this entire process and is used to cool not only the rooms, but the alcohol solutions, the precipitation mixtures, and the centrifuges.

The finished package of human serum albumin consists of a sterile bottle containing 100 cc of the solution, fitted with sterilized tubing, needle, and air filter. The entire package is complete and ready for immediate use.



KRAMER

Victory COOLMASTER

NEW DESIGN FOR *QUICK* DELIVERY

An all steel hot galvanized coil is used in the Victory Model Coolmaster. This line of units is designed to comply with the latest government limitations on crtiical materials. The number of models has been reduced to facilitate quick delivery.

OUTSTANDING FEATURES

Accurately rated. All ratings based on tests made in accordance with accepted standards and are guaranteed.

All steel spiral fin coil, hot galvanized after fabrication.

No welded or soldered return bends.

Can be used with Freon, Methyl, Sulphur, Ammonia, or Brine. Please specify if ammonia or brine will be used.

Heat interchanger is furnished.

One man suspension brackets for easier mounting.

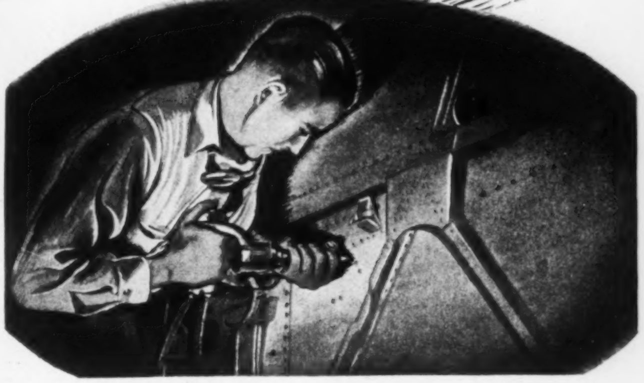
Unusually pleasing in appearance. Finished in chrome gray shade of crackle; baked on a bonderized (rustproofed) base.

Silent, carefully balanced fans, direct connected to totally enclosed motors specially built for fan duty and long life.

Send for Bulletin R-143

KRAMER TRENTON CO.
Trenton, N.J.

MEN
INDUSTRIES
NATIONS
Depend on REFRIGERATION accurately controlled . . .



One reason for America's superior might in weapons of war is Industry's new achievements in mechanical perfection. . . . Working in accuracies of ten-thousandths and millionths of an inch—on a production-line basis. Such accuracies were so minute that parts could be assembled only after they were subjected to shrinking or contraction by specially built Refrigeration units under controlled temperatures. . . . Another vital service of Refrigeration-at-war.

Here, as in all other phases of Refrigeration, the precision-control knowledge and experience developed at A-P is offering ready assistance, in more accurate and DEPENDABLE Refrigerant Control. Pacing new developments in the field, A-P Research Staff is already working with many manufacturers on post-war products that promise new and greater use for Refrigeration. This is a service YOU may be able to profitably use on your new plans!

AUTOMATIC PRODUCTS CO.
2460 N. Thirty-Second St.
Milwaukee 10, Wisconsin

Ap **DEPENDABLE**
REFRIGERANT VALVES

Stocked and Sold by Jobbers Everywhere

ADSCO BANNON TILE CONDUIT

Is designed with a BASE DRAIN

ONE FAILURE OF A PIPE CONDUIT WITHOUT BASE DRAIN MAY FLOOD ITS ENTIRE LENGTH

The base drain in ADSCO-Bannon Tile Conduit carries away ground seepage water — keeps insulation dry — prevents undue heat loss — prolongs life of the piping.

This strong vitrified tile conduit in combination with ADSCO Filler Insulation — a "Fiberglas" product — provides a permanent installation of high thermal efficiency.

Made of non-critical materials — prompt shipments. Send us details of proposed installation for quotation or ask for bulletin No. 35-67HP.

AMERICAN DISTRICT STEAM COMPANY

N. TONAWANDA, N. Y.

MAKING "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 60 YEARS.

EASY TO INSTALL GROUP OF PIPES

Split tile construction. Pipe can be worked on where you can get at it, then let down in place. No working in close quarters. Highly skilled labor not required.

RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 139. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Air Recovery and Heat Recovery

No. 4540—New bulletin on air recovery and heat recovery, pointing out how savings can be effected in fuel this winter through the application of air recovery equipment which permits the use over and over again of air that has been properly conditioned as to moisture and warmth. The bulletin has charts, tables, illustrations, and specific examples. In summer similar savings are obtained when air is cooled and otherwise conditioned.—W. B. Connor Engineering Corp., 114 E. 32nd St., New York 16, N. Y.

Bearings

No. 4541—32 p. booklet of facts about antifriction bearings, presenting in easy to read and understand form the whys and wherefores of bearing designs and uses. Among the topics discussed are why bearings are used, the function of each type of bearing, how loads are transmitted, etc.—Ahlberg Bearing Co., 3081 W. 47th St., Chicago 32, Ill.

Draft Control

No. 4542—16 p. booklet (800A) describing an automatic draft control device known as the "Draft-A-Justor" with which it is possible "to effect savings of 10 to 30 per cent in fuel consumption of natural draft boilers." The device operates by barometric pressure and automatically compensates for variations in outside temperature, pressure, wind velocity, and direction. Included in the bulletin is a graph showing relation between CO_2 and preventable fuel losses, a listing of essential requirements for a draft regulator, and a table of ratings.—Preferred Utilities Co., Inc., 1860 Broadway, New York 23, N. Y.

Electrical Insulating Materials

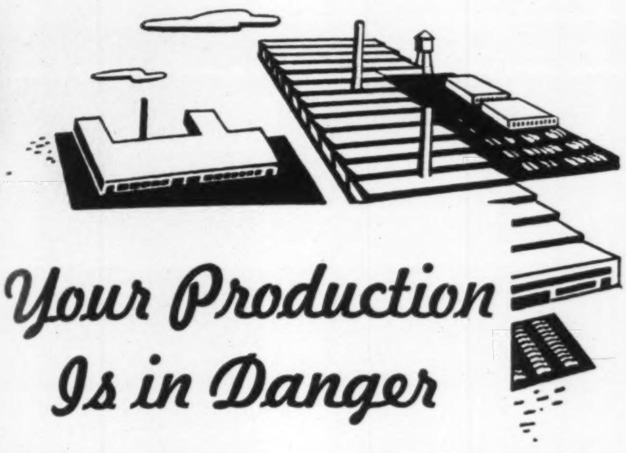
No. 4543—60 p. catalog covering the manufacturer's entire line of insulating materials, listing and describing hundreds of items including varnished cloths, varnishes, "Glyptals," tapes, cords, cotton sleeving, varnished tubings, mica, wedges, soldering materials, cements and compounds. Tab sheets separate the catalog sections, each of which is devoted to a different type of material, and in addition to a general index there is a separate index for each section. —General Electric Co., 1 River Rd., Schenectady, N. Y.

Felt Facts

No. 4544—22 p. booklet of felt facts, presenting the story of "an essential material for both civilian and war use" and describing the manufacture and some of the many uses of wool felt. Particular attention is called to applications as an alternate for rubber, cork, certain fabrics and plastics, and other materials. The importance of wool felt in improved vibration isolation and filtering is discussed.—Felt Association, Inc., 366 Madison Ave., New York 17, N. Y.

Flow Meters

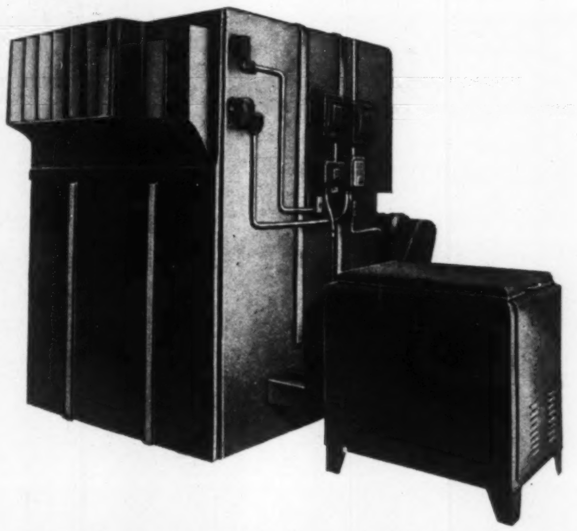
No. 4545—8 p. reprint (28) on how to keep flow meters accurate, by William C. Bennett, with sections on creating differential pressure by the primary element, transmitting differential pressure, installing the primary element, piping for meter installations, and measuring differential pressure. —Cochrane Corp., 3131 N. 17th St., Philadelphia 32, Pa.



Your Production Is in Danger

Shivering employees in cold, drafty rooms cannot work at top speed and accuracy. Install a Directherm Unit Heater. It will keep your plant warm—EVENLY warm—and the morale up. Absentee sickness costs many times more than a Directherm.

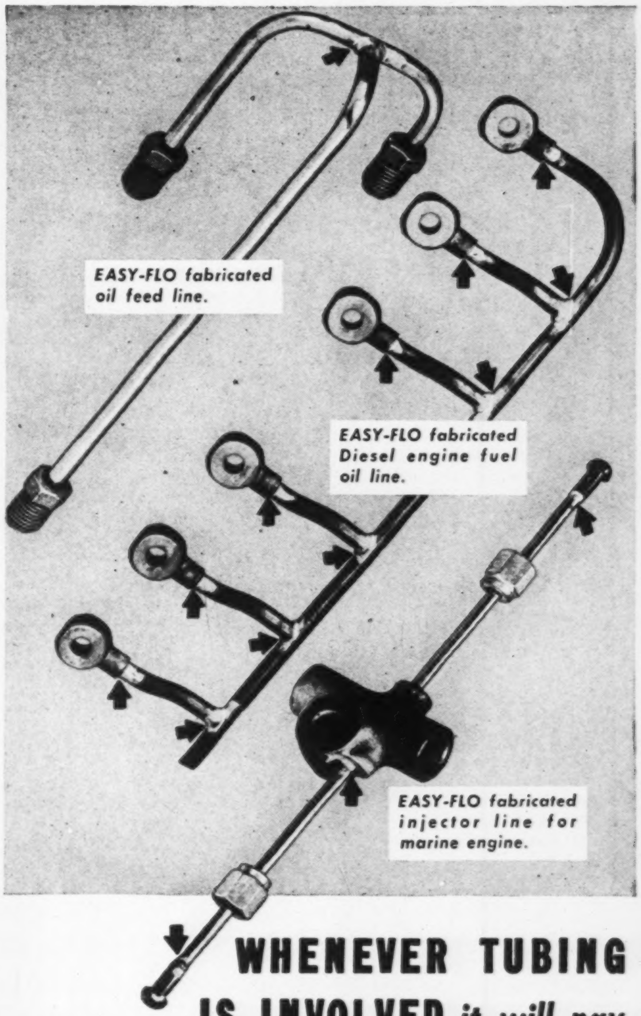
It Is Not too Late for This Winter If You Order Immediately



DIRECTHERM UNIT HEATERS

Made in six sizes (300,000—1,700,000 BTU). For coal, gas, and oil. No pipe or duct work. Easy installation. Automatic controls. No maintenance.

AIRTHERM MANUFACTURING COMPANY
711 S. SPRING AVE. ST. LOUIS 10, MO.


EASY-FLO fabricated oil feed line.
EASY-FLO fabricated Diesel engine fuel oil line.
EASY-FLO fabricated injector line for marine engine.

WHENEVER TUBING IS INVOLVED *it will pay you to* **design for, and specify SIL-FOS or EASY-FLO BRAZING**

It will pay because these two low-temperature silver brazing alloys meet every requirement of ferrous and non-ferrous tubing fabrication. They make air, gas and liquid-tight joints with consistent reliability and unequalled speed—joints with the strength and ductility to withstand severe vibration, shock and temperature changes—joints that are high in resistance to most corrosive agents. And they do all this at surprisingly low cost.

Three typical BUNDY TUBING jobs are shown above—all fabricated with EASY-FLO—and all done by girl operators, for it's easy to braze with these exceptionally free-flowing alloys.

BULLETIN 12-A GIVES YOU THE FULL SIL-FOS AND EASY-FLO STORY

and much useful metal joining information.
Write for your copy now.

HANDY & HARMAN
82 FULTON ST., NEW YORK 7, N. Y.
Bridgeport, Conn. • Chicago, Ill. • Los Angeles, Cal. • Providence, R. I. • Toronto, Canada
Agents in Principal Cities

BUY WAR BONDS

AIR CONDITIONING UNITS ☆

KENNARD FINNED COILS

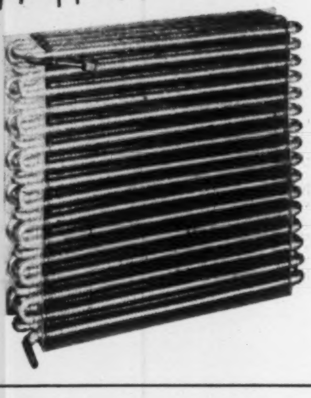
SOLVE YOUR COIL PROBLEMS THIS EASY WAY

Just write us what you want and when you want it. Our engineering department will help you solve your problem—give you complete specifications, blue prints and prices, plus assurance of PROMPT DELIVERY.

HEATING COILS for use with steam or hot water.

COOLING COILS for use with direct expansion refrigerants, cold water or brine.

We are equipped to fabricate most types of STEEL COIL. Steel coils available either hot dipped galvanized, or paint dipped. COPPER COILS on W.P.B. approval.



Hot-dipped galvanized steel coil for refrigeration blower unit.

SAM KENNARD INC.

4821 Easton Ave.
ST. LOUIS 13, MO.

☆ REFRIGERATION BLOWER UNITS

WECO-N. G. E. Series F600 GAS BURNERS

These burners are available for ratings from 50,000 to 10,000,000 B.t.u. output, for use in heating boilers, power boilers—in any metal firebox or sectional boiler.

Featuring flexibility to meet various firebox shapes and sizes at various gas pressures, and low draft loss. Full automatic controls that operate properly can be easily applied.

GUARANTEED VIBRATIONLESS

This burner operates on straight natural gas and mixed gas to 800 B.t.u. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

THE WEBSTER ENGINEERING CO.

TULSA —DIVISION OF— **OKLAHOMA**

Surface Combustion . . . . Toledo, Ohio

Fuel Conservation

No. 4546—A mailing piece addressed to property owners on the importance of conserving fuel in wartime, what it means to the nation, and what it means to the owner.—McDonnell & Miller, 400 N. Michigan Ave., Chicago 11, Ill.

Glass Block

No. 4547—24 p. booklet on methods of replacing wornout windows with "Insulux" glass block, with photographs of typical installations, specifications, technical data, and construction details. According to the booklet, use of glass block in industrial buildings reduces heat loss and heat gain, saves critical materials, improves lighting, reduces maintenance costs, eliminates infiltration of dirt and dust, and improves appearance.—Owens-Illinois Glass Co., Insulux Products Div., Toledo, Ohio.

Heating Control for Apartments

No. 4548—16 p. booklet announcing "personalized" heating control for apartments as an essential in the postwar apartment, summarizing its advantages to owners or operators and showing the disadvantages that such control will overcome. How personalized apartment heating control is achieved by individual apartment control, sectional control of individual apartments, and individual room control, is described in detail, and the control equipment itself is illustrated. There is also a section on boiler control systems. Results of a survey which show that tenants desire such control are summarized. Also, a 4 p. leaflet announcing a $10,000 competition for apartment heating designs, for which entries postmarked not later than November 15 may be submitted.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn.

Humidifiers

No. 4549—8 p. bulletin on humidifiers for industrial applications such as paper storage rooms, textile mills, ammunition loading lines, printing plants, woodworking shops, tobacco factories, pharmaceutical plants, leather tanneries, testing laboratories, and others. Data are included on humidification for control of dust, lint and static electricity, and for increasing human comfort and efficiency. A partial list of users is shown.—Armstrong Machine Works, 874 Maple St., Three Rivers, Mich.

Industrial and Ventilation Filters

No. 4550—40 p. catalog (209) on air filters, with technical information on automatic air filtration and engineering data on automatic air filters, panel filters, wire clad filters, fiber frame filters, window ventilators, and industrial filters. Numerous illustrations, diagrams, and dimension and capacity tables are presented.—Staynew Filter Corp., 11 Centre Park, Rochester, N. Y.

Insulation and Protection of Piping

No. 4551—4 p. folder containing a general description of the manufacturer's entire line of products for the insulation and protection of steam, hot water, oil, and process liquid distribution piping. This bulletin is a preface to the manufacturer's 1944 general catalog to be released later.—Ric-wiL Co., 1562 Union Commerce Bldg., Cleveland, Ohio.

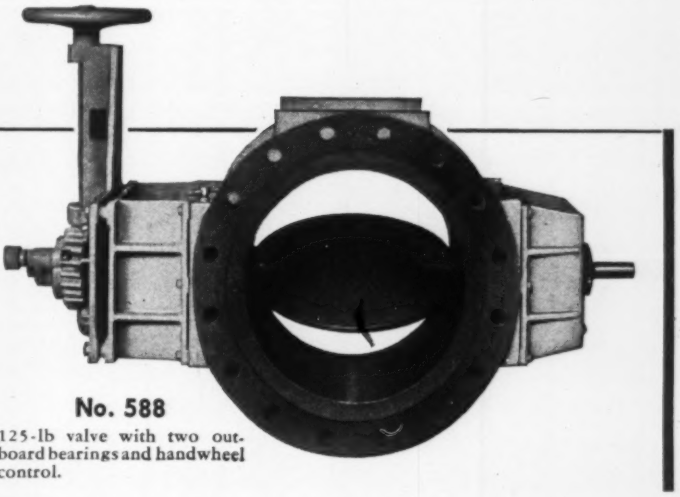
Liquid Filters

No. 4552—8 p. bulletin on liquid filters for oil, water, chemicals, etc., available in a wide range of models, sizes, and capacities. Features of the various types are described and illustrated and tables of sizes are given.—Staynew Filter Corp., 11 Centre Park, Rochester 4, N. Y.

Lubricating Oil Purifiers

No. 4553—6 p. bulletin on "YM" lubricating oil purifiers and reclaimers, covering units with capacities ranging from

DOUBLE DUTY
DOUBLE-QUICK
ACTION



No. 588
125-lb valve with two outboard bearings and handwheel control.

Throughout American Industry, Butterfly Valves have long been recognized as the ideal type for the control of volume and pressure. With the improved R-S precision machined, wedge type design, these valves are also used with equal effectiveness for the shut-off of any material that flows or is forced through a pipe.

No. 587
Power operated by air diaphragm motor. Hand wheel for use in case of power failure.

15 to 900 psi
for air, gas, steam, liquids and semi-solids. Substitute metals are available for resistance against heat, abrasion and corrosion.

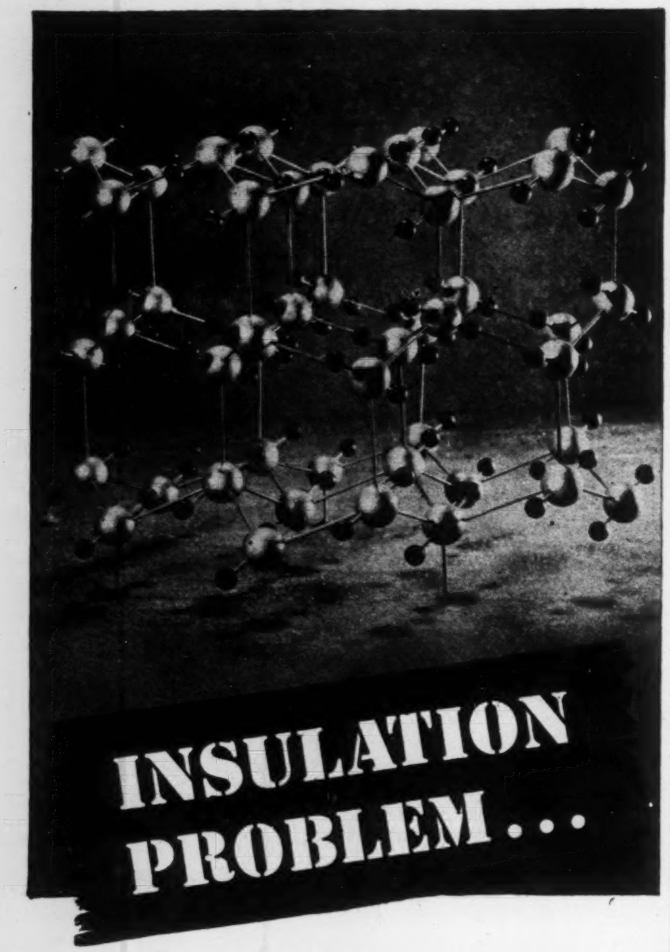
The beveled vane seats at an angle against the valve body and tends to close itself under a pressure drop. Four to six revolutions of the hand wheel completely open or close the valve vane—that's double-quick action. Manually or power operated under pressures up to 900 pounds and from extremely high temperatures to sub-zero refrigeration conditions. R-S Butterfly Valves meet today's need for non-complicated construction, simplified operation and lower over-all costs.

R-S
QUALITY PRODUCTS SINCE 1906

Write for detailed specifications.

VALVE DIVISION
R-S PRODUCTS CORPORATION
132 Berkley Street • Philadelphia 44, Pa.

R-S *Streamlined* BUTTERFLY VALVES



THE STRUCTURE shown above represents one of the fundamental insulation problems in refrigeration. It is, in effect, the "catalyst" in which vermin and mold breed . . . it favors the activities of termites . . . and it is the basic cause of rot. It is a physicist's representation of molecules of water . . . in crystal form, as ice. The small balls represent hydrogen atoms, the large balls oxygen atoms.

Water, or moisture, causes no insulation problems, however, when J-M Rock Cork is used for low-temperature insulation. For J-M Rock Cork is sealed against moisture . . . is immune to termites, vermin, mold. It can't rot, does not absorb odors.

Rock Cork is essentially mineral wool, one of 4 basic materials from which all Johns-Manville products stem: Asbestos, asphalt, diatomaceous earth and mineral wool.

Today, the prime task of Johns-Manville is to make these products as fast and as well as possible for war needs until Victory is won. Johns-Manville, 22 East 40th St., New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville
ROCK CORK

2½ gal in 70 to 90 min to 120 gal. These reclaimers are recommended by the manufacturer for restoring all types of used oils, including oils drained from diesel engines, compressors, gas engines, ice machines, vacuum pumps, etc.—Youngstown-Miller Co., Sandusky, Ohio.

Motors

No. 4554—20 p. catalog (GEA-4092) on "making motors a part of your product", with references to features of "G.E." motors that are of particular advantage to the machinery manufacturer. The bulletin gives complete information including dimensions on many different mechanical mounting arrangements for both integral and fractional horsepower standard and special motors.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Motors

No. 4555—12 p. bulletin (1160) announcing a new protected polyphase squirrel cage motor, summarizing its features, describing its advantages for general purpose duty, discussing installation, and giving dimensions, frame sizes, and motor characteristics.—Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

Pipe Line Filters

No. 4556—8 p. bulletin on pipe line filters for air and gases, in pressure and vacuum types and available in a complete range of models, sizes, and capacities. Basic construction is described and illustrated, and size and installation data are given.—Staynew Filter Corp., 11 Centre Park, Rochester, N. Y.

Prefabricated Construction

No. 4557—40 p. manual on "Lindsay Structure," a strong, light steel prefabricated construction that can be assembled with simple wrenches and is suitable for many purposes including cabinets, machine housings, refrigeration units, processing rooms, industrial buildings, etc. The manual shows how the structure can be used in the industrial, automotive, and marine fields and contains technical information and construction suggestions.—Lindsay and Lindsay, 4825 S. Rockwell St., Chicago, Ill.

Proportioning Equipment

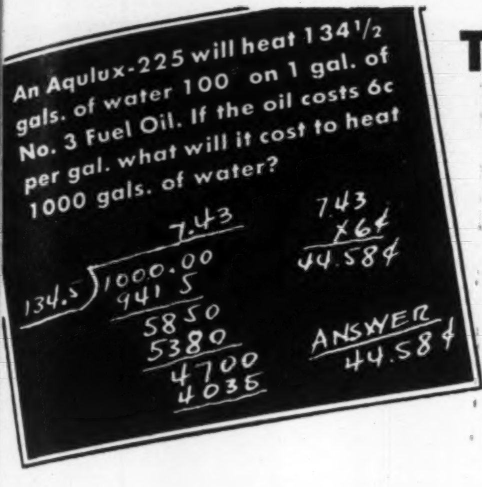
No. 4558—4 p. bulletin (2985-A) on air actuated type proportioning equipment for corrosive fluids, describing a simple method of proportioning sulphuric acid to water supplies. The principle of operation and its advantages are fully described.—Cochrane Corp., 3131 N. 17th St., Philadelphia 32, Pa.

Pumps

No. 4559—60 p. catalog (43) on "Westco" industrial pumps, designed to give the complete story about each of these pumps, plus brief descriptions of the manufacturer's line of "Pomona" pumps. There are sections on general information, design detail, principle of operation, operating characteristics, industrial pumping units, condensation return units, automatic boiler feed units, and vertical pumps. Sample specifications are included and there is a 4 p. section of general engineering data, with numerous tables. —Joshua Hendy Iron Works, Pomona Pump Co. Div., 206 E. Commercial St., Pomona, Calif.

Testing Welds

No. 4560—Article on methods of testing welds from October issue of Oxy-Acetylene Tips, describing and illustrating certain tests that can be made in the average welding shop. The tests considered are the observation test, bend test, nick break test, ductility test, pressure test, stethoscope test, x-ray test, microscopic test, and hardness test.—The Linde Air Products Co., Unit of Union Carbide and Carbon Corp., 30 E. 42nd St., New York, N. Y.



An Aqulux-225 will heat 134½ gals. of water 100° on 1 gal. of No. 3 Fuel Oil. If the oil costs 6c per gal. what will it cost to heat 1000 gals. of water?

```
         7.43
134.5 ) 1000.00
         941 5
          5850
          5380
           4700
           4035
```

```
  7.43
  x6¢
 44.58¢
```

ANSWER 44.58¢

This Hot-Water-Arithmetic helped convince the Army and Navy!

. . . AQULUX PERFORMANCE FIGURES that all Heating Engineers and Architects should know!

ONE GALLON of No. 3 Fuel Oil will heat 134½ gallons of water to 100° F. rise in 22 1/5 minutes, . . . when burned in an Aqulux-225 operating at full rated capacity.

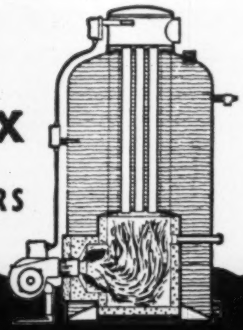
In 24 hours an Aqulux-225 will heat 6486 gallons of water to 100° F. rise with a total fuel consumption of 48 1/5 gallons. If No. 3 Oil is priced at 6c, the total fuel cost to heat 6486 gallons would be only $2.89. Low operating costs like that aren't just an accident. They are directly traceable to the extraordinary Efficiency which has been engineered into the Aqulux-225 . . as evidenced by these operational tests:

Stack Temperature at Full Capacity . . . . 400° F.
CO_2 . . . . 12% Stack Loss 14%
EFFICIENCY RATING 80%

And don't forget, . . these are the performance figures of a *wartime* model built without insulation or jacket.

When you want dependable, low-cost hot water (or any other form of efficient oil heat) do as the Army and Navy did when they bought Aqulux Water Heaters, . . thoroughly investigate the performance of Johnson oil-burning equipment. Heavy duty Aqulux models with capacities to 540 g.p.h. are available for orders approved by W.P.B. May we send you prices and other data? S. T. Johnson Co., 940 Arlington Ave., Oakland 8, Calif., and 401 No. Broad St., Philadelphia 8, Pa.

AQULUX
Heavy Duty
WATER HEATERS

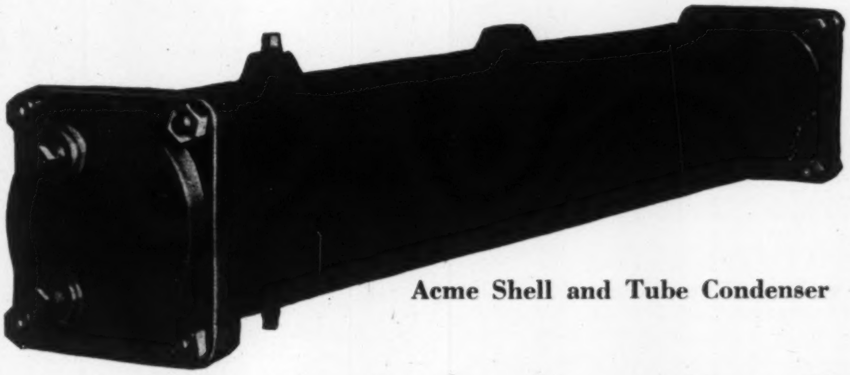


S. T. JOHNSON CO.

40 years of engineering and building fine Oil Burning Equipment

---

Replacement Water-Cooled Condensers

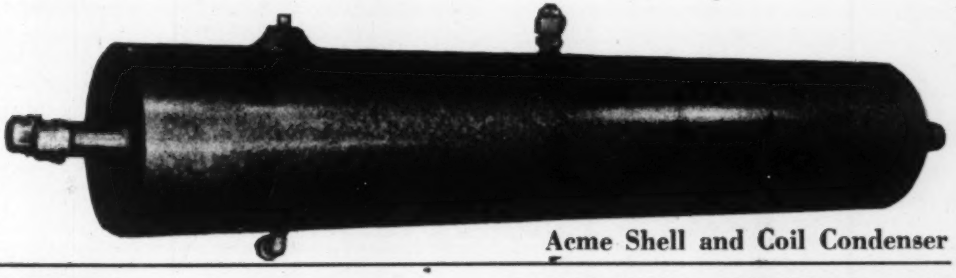


Acme Shell and Tube Condenser

Small size replacement condensers are in demand today. We offer immediate shipment on Freon and Methyl Chloride shell and coil condensers in sizes 1/3 to 5 tons and also shell and tube cleanable condensers in sizes ½ to 7½ tons. Write for catalogs No. 23 and No. 24.

In Stock for Immediate Delivery

ACME PRODUCTS ★★★



Acme Shell and Coil Condenser

ACME INDUSTRIES ★ JACKSON, MICHIGAN

CLEAR YOUR PLANT OF
WELDING FUMES!

GUARD EMPLOYEE HEALTH by installing Ruemelin Fume Collectors wherever welding operations take place. They remove noxious gases, heat and smoke at the source . . . eliminate employee fatigue . . . speed up welding operations. Especially valuable in winter when doors and windows must be closed. Hundreds in operation all over the country. Write for bulletin No. 37-C.

RUEMELIN MFG. CO., 3896 N. Palmer St., Milwaukee 12, Wis.

RUEMELIN FUME COLLECTOR

Heat gate houses and other remote rooms ELECTRICALLY

The simple, convenient, and safe way to heat any small isolated spot or room is with one of the various types of

CHROMALOX
ELECTRIC
AIR HEATERS

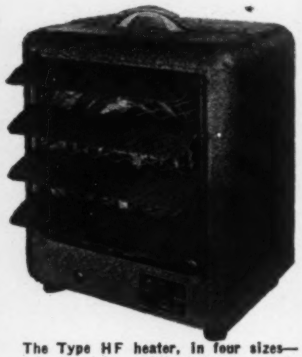
As easy to install as an electric light—they eliminate all steam heat piping troubles—

They provide clean, fumeless, warmed air, avoiding the carbon monoxide dangers of flame heat in constricted areas—

They eliminate the hazard of naked flame—

They cost little or no more to operate than other forms of heating—

They are available in permanent or portable types, various sizes for convection or blower operated, capacities from 1 kw. to 40 kw.



The Type HF heater, in four sizes—1.5 to 4-kw. Other types up to 40-kw., for heating large areas. Chromalox heaters can be supplied with thermostatic control if desired.

Chromalox Type D Air Heater, light, portable, sturdy construction. Equipped with 3-heat switch. Four sizes, 1 to 3 kw.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh 8, Pa.

NEW BOOKS & REPORTS

Recommended Heating Boiler Loads

The Heating, Piping & Air Conditioning Contractors National Association, 1250 Sixth Ave., New York 20, N. Y., recently published the fourth edition of part 2 of its engineering standards on net square feet radiation loads in 70 F, recommended for low pressure heating boilers. Developed by the boiler output committee of the HPACCNA, the data enable the contractor to apply the same formula to boilers which are not listed by name of manufacturer and catalog number in the HPACCNA net load recommendations for heating boilers, as the committee has applied for him to the boilers so listed.

Information in convenient form on mechanical firing is given in the book.

The price is $1.00 per copy. Engineering standards material published by the HPACCNA should be ordered through the local associations affiliated with the national association.

Earlier this year, the fourth edition of part 1, the engineering standards on heat loss calculations, was published. Before the end of the year the association is planning to publish and distribute part 3 on pipe sizes and part 4 on air conditioning.

Heat and Power Conservation

An Industrial Heat and Power Conservation Manual was issued last month by the Industrial Mineral Wool Institute, 441 Lexington Ave., New York, N. Y. Copies may be obtained on request to the institute.

This 20 p. manual presents engineering methods of calculating and reducing preventable heat and fuel losses and gives nine typical examples of savings. The heart of the method is a heat loss estimate sheet which carries space for listing uninsulated surfaces discovered in a heat loss survey. Other columns provide space for a simplified step by step calculation of the bare surface heat loss, heat loss through different insulation thicknesses, and the savings effected. Time saving graphs, tables, formulas, and examples are included.

NATIONAL WAR FUND
THREE FRONTS · ONE CAUSE

The manual covers such topics as how to find heat and fuel losses, how to figure how much can be saved, and how long it would take to cover the cost of insulating by means of fuel savings.

Tests of Steam Pipe Insulation

The July, 1943, Transactions of the American Society of Mechanical Engineers includes a paper on Tests of Steam Pipe Insulation, by E. A. Allcut, professor of mechanical engineering, University of Toronto, which was presented at the annual meeting of the ASME last December.

In connection with various war projects some questions arose which made it necessary to design an apparatus suitable for testing the heat transmission through cylindrical samples of various kinds of thermal insulating material used for protecting hot pipes. With this apparatus the properties of spun rock wool were investigated with regard to the effects of density, binder, and thickness. Other experiments were made on glass wool and corrugated asbestos. The influence of wind and the protection of the outer surface of the insulation by metallic coverings were investigated, as also was the protection of fabric coverings by paints of various kinds and colors. It was found that even bright metals such as copper and aluminum made but slight difference in the heat losses, and that most paints increased the losses as compared with those from the unpainted fabric. The details are given in the seven tables and seventeen curves accompanying this paper.

Copies of these Transactions may be obtained for $1.50 from the ASME, 29 W. 39th St., New York, N. Y.

Postwar Jobs and Profits

The Bureau of Foreign and Domestic Commerce of the U. S. Department of Commerce recently issued a booklet, Community Action for Postwar Jobs & Profits, designed to help local communities throughout the country to strengthen their economic foundations in readiness for the postwar era. It is intended as an "action" guide for the use of local leaders in working out plans to take inventory of community assets, needs, and potentialities, and putting them into effect. It is based on accomplishments in 487 different communities, mostly of moderate size and scattered over the country, which have already adopted a somewhat similar program.

Guide sheets are provided to simplify surveys. Communities are cautioned not to attempt to do everything at one time, but to choose lines of activity which promise the best results locally, and to push them hard.

An activity particularly urged upon all communities is the adoption of a "work pile plan", which is a survey based on the belief that practically every business firm—from the smallest retail store to the largest factory—knows of certain expenditures for repairs, modernization, expansion, or conversion which it will probably make after the war.

Copies of the booklet have been published in a limited edition for business and community leaders. Requests should be sent to the Bureau of Foreign and Domestic Commerce.

AIR CONDITIONING NOZZLES

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-616

YARNALL-WARING COMPANY
107 MERMAID AVENUE
PHILADELPHIA 18, PA.

YARWAY

Open Season on Traps

For industrial plants, apartments, hotels, institutions, residences, power plants, central heating systems, utilities . . . wherever steam is used for heating or processing.

It's on now . . . dirty traps must go AND STAY GONE . . . and there's only one way to do the job safely, surely, scientifically . . . that's the Rid-Sludge way . . .

NO MANUAL CLEANING OF TRAPS NECESSARY!

Manual trap cleaning is futile if pipe lines and radiators are loaded with sludge. Rid-Sludge cleans the ENTIRE steam system, without interrupting service. Rid-Sludge drives sludge from traps and from all lines, radiators and all other parts of the steam distribution system . . . Write today for full details on Rid-Sludge. A national engineering service is maintained for your convenience!

SLUDGE WEARY TRAP

APEX ALL-WEATHER PRODUCTS CO.
1525 EAST 53rd STREET
CHICAGO (15), ILLINOIS

TRAP RID OF SLUDGE

GET THAT AIR OUT OF THERE

With an AUTO-VENT AIR ELIMINATOR

Circulation Troubles?

Why continually fight air pockets or traps in hot or cold circulating lines? You can "get that air out of there" *and keep it out* simply by installing the No. 7 Maid-O'-Mist Automatic Air Vent. This reliable air vent has a self-closing float-controlled valve and is designed especially for circulating pipe lines, concealed radiators, unit heaters, cooling manifolds, tanks, diesel engines, or any other application where air pockets or traps retard the free circulation of liquids.

Now available in bright brass finish.

APPROVED FOR NAVY, MARITIME COMMISSION AND ARMY USE.

MAID-O'-MIST INC.
1 NORTH ABERDEEN STREET
CHICAGO 7, ILLINOIS

AUTOMATIC HUMIDIFIERS
FOR ALL TYPES OF HEATING SYSTEMS

CORK FOR ALL PURPOSES

NOW AVAILABLE

Corkboard and moulded cork pipe covering are now available without priority for air conditioning and other applications of low temperature. To obtain maximum power savings, use Mundet Cork Insulation. We shall be glad to help in the preparation of specifications. Mundet Cork Corporation, Insulation Division, 65 S. 11th St., Brooklyn, N. Y.

MUNDET
CORK INSULATION

CONSERVES LOW TEMPERATURE

GEHL STOKERS *will get you those* HEATING PLANT CONVERSION SALES

- Rust-resisting, all cast chassis.
- Barometric Control—automatically controls chimney draft—a big fuel saver.
- Other sales-winning advantages.
- Engineered to do a better job.
- A 76-year-old company.

There's Stoker Business to be had—get your share of it. Urge your customers to get their orders in as soon as possible. It takes time to arrange Government priorities.

Models for factories, warehouses, public buildings, office buildings, schools and churches.

Write for catalog and our plan of dealer cooperation.

GEHL BROS. MFG. CO.
Established 1867
Dept. BK-830, West Bend, Wisconsin

A GEHL WINS FRIENDS WHEREVER IT GOES

Federal Housing Authority Issues Heating Guide

Increased fuel conservation and improved heating comfort for war workers through greater efficiency in the operation of heating equipment next winter are expected to result from studies recently completed by heating engineers from private industry at war housing projects in various sections of the country, according to the Federal Public Housing Authority.

Decision to employ consulting engineers to make surveys and recommendations on war housing heating equipment was made by the FPHA in an effort to conserve fuel and to secure reasonable comfort. Guidance was found to be particularly needed at projects with individual tenant operated heating equipment, but a higher degree of efficiency is also sought by FPHA in the operation of equipment in centrally heated projects.

The studies were undertaken on the premise that no heating system will give satisfactory service with the minimum use of fuel, unless heat loss is minimized and the system properly operated. Moreover, top efficiency is required in the current fuel emergency.

The findings and recommendations resulting from the studies are set forth in a Heating Correction Guide being distributed by the FPHA to war housing project managers and tenants. The guide covers common causes leading to unsatisfactory heating conditions and recommends solutions. Experts report that unsatisfactory heating is frequently traceable to the use of improper sizes and grades of coal.

The guide covers four types of heating equipment: (1) forced warm air (project operated) non-recirculating systems; (2) forced warm air (project operated) recirculating systems; (3) forced warm air (tenant operated); and (4) individual space heaters.

On account of war restrictions on the use of gas and oil fuels, the publicly financed war housing projects are to a large extent heated with coal fired equipment. Discontinuance of oil heating equipment was ordered in all projects where feasible early in 1942, and many of the older publicly financed projects have been converted from oil to coal fired equipment within the last year.

The consulting engineers who surveyed the heating equipment in the war housing projects were William K. Karsunky, Krey & Hunt, and Warren & Ronald.

Report on Patented Flue

The Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago, Ill., recently published a report identified as Miscellaneous Hazard 2962, Vitroliner Flue—Type E, which flue is manufactured by the Condensation Engineering Corp., of Chicago. The report includes an introduction, claims made for the device, the plan of investigation, examination and test record, commentary, record in service, and the conclusions.

In the conclusions it is stated that this flue is practicable to install and the probability of misinstallation is remote. It is also stated that the flue is believed to afford adequate safety from fire in the structure in which it is installed.

Plan Postwar Jobs Now

The Committee For Economic Development, Suite 3311, Department of Commerce Bldg., Washington 25, D. C., issued last month a booklet entitled Plan Postwar Jobs—Now. This is a part of the committee's program to stimulate private business, on a company by company basis in each community, to plan at the present time for postwar employment.

The booklet was prepared primarily for manufacturing and allied businesses whose success is dependent on national economic factors rather than on local economic conditions. It describes national postwar goals and approaches to be used by individual industrial companies in planning to reach such goals.

Weir Flow In Overflowing Tanks

Among the papers presented at the recent meeting of the American Chemical Society in Pittsburgh, was a discussion of Weir Flow in Overflowing Tanks, by Karl Kammermeyer of the Publicker Commercial Alcohol Co. Following is an abstract of the paper:

In connection with the development of a design method for thickening tanks, the problem of tanks overflowing at the perimeter was encountered and interpreted as being analogous to the weir flow of liquids. The available literature data on weir flow at low heads were correlated and experimental data at extremely low heads were obtained on a 35 in. diameter tank. All data could be correlated in a satisfactory manner by plotting the weir head against the volume flowing per unit length of perimeter.

Two definite types of flow were shown to exist and empirical equations for the two flow conditions were developed which should be suitable for engineering calculations for water and probably dilute aqueous solutions.

Radial surface velocity distributions were also determined in the 35 in. tank and it was found that a considerable amount of the overflowing water was flowing in a very thin sheet at the surface.

Calculator Figures Daily Fuel Oil Ration

By the twist of the dial of an inexpensive calculator, it is possible to determine at any time during the heating season whether more or less fuel oil than the ration board has allotted is being burned.

The calculator was designed by D. B. Anderson, who was recently honored with a degree of professional engineering by the University of Minnesota because of his work in measuring the efficiency of insulation. Calculations made in the development of his instrument were based on data given in the Guide of the American Society of Heating and Ventilating Engineers.

The calculator consists of two circular discs and is operated by setting the pointer opposite the fuel oil allotment for the year and then reading around the circumference the allotment by day, week, or month. Further details may be obtained from the Anderson Specialty Co., 215 E. 9th St., St. Paul, Minn.

Ship Outfitter's Handbook

The Ship Outfitter's Handbook, by Emil M. Hansen, is intended to help the new man in the shipyard to understand the "why" rather than the "how", in his duties as an "outside machinist". All information is up to the minute in regards to modern shipfitting practice, but strongly reflects that used at the New York Shipbuilding Co. with a generous seasoning of U. S. Navy standards.

To benefit thoroughly from this book, one must have had some preliminary shipyard training and a willingness to do some intensive studying, as it is not a primer for the novice. It should be helpful to the engineer not familiar with ship's plans and nomenclature, but whose work today, when everyone is building ships, has become involved in this phase of the war effort.

The contents start out in a very elementary manner by dealing with the various systems, types of drawings, and symbols used. A glossary of abbreviations and definitions of ship's terms precede a description of the ship's structure, and a very good chapter on what to look for on a plan before starting a job. This is followed by a list of the more important shipfitters jobs, together with "do's and dont's" on actual installation work. Templates, their type and application, tests of work, tools, shop fabrication, and safety first are given ample coverage.

The concluding chapter gives tables and other data useful to the ship outfitter and not generally assembled in one volume.

The publisher is the Cornell Maritime Press, 241 W. 23rd St., New York, N. Y. There are 290 pp., 6 x 9 in., and 17 folding plates. The price is $3.00.—S.B.F.

FULL ACTIVE GRATE SERVICE

without dead plates

MORE grate area—with low combustion rate per square foot! . . . Frederick Stokers have fully active, self-contained burning ends, with specially designed, heavy-ribbed tuyeres, and with air ports so arranged and proportioned as to insure correct air distribution and maximum efficiency in combustion!

Just one of many new developments, Frederick engineered, this new burning end and other Frederick developments for increased stoker efficiency, convenience and economy are described fully in folder free upon request. Write for your copy —today.

FREDERICK INDUSTRIAL STOKERS

The FREDERICK IRON & STEEL CO.
East Seventh St., Frederick, Maryland

Centrifugal Pumps for All Purposes

Detect Dirty Filters
0-.1 .2 .3 .4 .5
HAYS
and Save

with a HAYS AIR-FILTER GAGE

Why let dirt clogged filters decrease air-circulating efficiency and increase power costs when a Hays Air-Filter Gage will tell you when to change the filter? This gage indicates air-flow through filter at all times . . . it will signal when filters need cleaning or changing. It will also operate a damper to control air flow through the duct. Write 990 Eighth Ave., Michigan City, Ind., for A-F G. Bulletin.

The HAYS CORPORATION
SINCE 1905
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A

ECONOMY SCV PUMP

... engineered to meet YOUR needs!

Vertical in design, the ECONOMY SCV Pump saves space and installation time wherever it is used. The vertical design places the motor high—away from dirt and splash. Impeller mounted between two outboard bearings runs quietly—eliminates shaft whip. In the event of motor failure any comparable stock motor may be easily adapted, thus "downtime" is kept at minimum. The SCV Pump is adaptable to any service where water or clear liquids are handled. Capacities from 10 to 500 G. P. M.—heads up to 225 feet.

For detailed information, send for Catalog D2-1042.

Economy Pumps, Inc.

1020 WELLER AVE. HAMILTON, OHIO

WANTED

Two Men with Experience in

WARM AIR HEATING

DESIGNING ENGINEER who is fully conversant with modern design trends in warm air and air conditioning equipment.

SALES ENGINEER, experienced in the warm air heating field and with ability to handle sales.

Good opportunity—with an established company. Write in strict confidence. Give full details of experience, education and personal qualifications in first letter.

Address Box 378-A, Heating, Piping & Air Conditioning

6 No. Michigan Ave., Chicago 2, Ill.

Government Publication On Products and Priorities

A new publication, designed to aid business men and government officials in obtaining information on all products, materials, and service handled by the War Production Board will be issued by WPB every four weeks, it was announced last month. Titled Products and Priorities, it will include all information formerly contained in Priorities and in Product Assignments, both of which are discontinued. A year's subscription of 13 issues may be obtained for $2.00 from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. Single issues are available at 20 cents each.

A feature of Products and Priorities is a master alphabetical index listing every product, material, or service which comes under WPB supervision or control. This will enable business men and others to determine easily the numbers of any applicable WPB orders and forms, all necessary CMP references, and the WPB division and section responsible for the product, material, or service. It also includes a list of claimant agencies, claimant agency program symbols, and other information for which a public need is indicated.

★ *It is good business, as well as your patriotic duty, to save fuel—coal, oil, or gas—by heating efficiently. Uncle Sam wants you to fight waste!* ★

Studies in Arc Welding

Ninety-six papers on arc welding, submitted by technicians and engineers in the James F. Lincoln Arc Welding Foundation's 1940-42 industrial progress award program, have been edited and published in book form under the title Studies in Arc Welding—Design, Manufacture, and Construction.

The volume is the result of the careful editing of papers on arc welding practice representing the work of 113 engineers, designers, works managers, superintendents, executives, foremen, and other technicians, each of whom applied himself individually to a specific design study involving arc welding.

Many of the studies involve plants now engaged in war production but the principles and practices reported are also applicable to industrial design and manufacture in the postwar era.

"One of the chief contributions which this volume will make in our industrial progress," the foundation award jury states, "lies in what the studies point out as the economies of modern arc welding. Hundreds of millions in dollars could be saved by adopting arc welding in the design and manufacture of many steel products. 'Studies in Arc Welding' makes available the knowledge of many engineers who support this view."

The contents of the book are arranged in nine sections with 98 chapters. Each chapter covers a specific design subject; each section covers a particular field—automotive, aircraft, railroad, watercraft, structural, furniture and fixtures, containers, machinery, and commercial welding.

There are six chapters in the 58 p. containers section, the subjects being liquefied gas storage containers, design and production of heat exchangers, the drumless boiler, arc welded power penstocks, welded water wheel center casing, and an all arc welded steam line. The aircraft section has a chapter on arc welding airplane boilers. In the railroad section, there is a chapter on arc welded suspension for air conditioning systems. The machinery section has a chapter on an experimental 7½ ton refrigeration plant, and a chapter on downdraft ventilation for a plant welding shop. There are also chapters in this section on a batching scraper for crude oil pipe lines, and redesign of an oil-gas furnace.

Copies of this book may be had for $1.50 in the U. S. ($2.00 elsewhere) from the publisher, the James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio. There are 1295 + xxxi pp., 6 x 9 in.

Booklet on Controlled Materials Plan

Manning, Maxwell & Moore of Bridgeport, Conn., manufacturers of pressure gages, safety and relief valves, industrial thermometers and globe valves, are distributing a new 16 p. booklet entitled The Controlled Materials Plan—A Simplified Explanation of Purposes, Principles and Procedures. It has been prepared to assist key individuals in war industries and distributor organizations to gain a sound working knowledge of CMP.

The booklet covers such topics as what materials are controlled, how controlled materials are allotted, how controlled materials are distributed to producers, what governs deliveries, buying maintenance, repair, and operating supplies, and priorities for distributors. In addition, there are detailed flow charts describing the functioning of producers of class A and class B products.

Metals and Alloys Data Book

The Metals and Alloys Data Book, by Samuel L. Hoyt, technical adviser, Battelle Memorial Institute, is a presentation of a mass of technical facts about metals and their alloys, principally in tabular form, with some graphs and illustrations, and here and there a bit of text.

This excellent work probably is not the first instance of a book being written because its author became exasperated at not being able to find the information he wanted in any existing book, and so resolved to write the book himself. The author states in his preface that his book "is the direct outgrowth of an attempt to satisfy a desire of my own to accumulate reliable data on the metals." It is fortunate for the metals industry that he felt so impelled, for the result is indeed a useful compilation.

The book opens with an introductory chapter illustrating test specimens for tensile, compression, and impact tests. Chapter 2, dealing with hardness tests, includes 13 tables. The next five chapters, devoted to iron and steel, contain 237 tables and 35 graphs. There follow two chapters on nonferrous alloys and miscellaneous metals, with 71 tables and 10 graphs. The 10th and concluding chapter contains 19 tables of general data and 18 photomicrographs of grain structures.

The data cover practically every important property of metals and alloys: chemical composition; tensile, yield, and impact strengths; elongation and reduction of area and elasticity; hardness; machinability and other attributes. Included are plain carbon, low alloy and high alloy wrought steels; cast steels, stainless steels and cast irons; heat and corrosion resistant cast alloys; aluminum and its alloys; brasses, bronzes, and other copper alloys; nickel, chromium, zinc, tin, lead, and their numerous alloys; beryllium, cadmium, bismuth, and other less common metals.

There is a generous amount of data on heat treating and its relation to the physical properties. Information is given on various quenches, drawing temperatures, and effects of mass in hardening.

The sources of the data are generally shown, and are generally authoritative. There are some sound remarks regarding the need for caution in selecting and applying tabular data and as to the significance of minimum, maximum, and average values. Mr. Hoyt modestly states that his book is for information, not for instruction, but the observant reader could hardly fail to learn much from its pages.

Since a book of this sort is used principally for reference, its usefulness is dependent largely upon its index. Mr. Hoyt has prepared an extensive index, and has taken pains to consider the varying terminology of the industry. The publisher is to be complimented upon the handling of the difficult typography, and for having supplied a durable ledger paper in anticipation of much thumbing of pages.

The publisher is the Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y. The book has 334 + xvi pages, 6¾ x 10 in., and its price is $4.75.—*K.S.*

Pumps for MODERN INDUSTRY

Type GMC Close-Coupled Centrifugal

Type AD Hor. Split Case, Two Stage Centrifugal

AURORA CENTRIFUGAL PUMPS for WATER SUPPLY • CIRCULATING • CHEMICAL HANDLING • TRANSFER • CONDENSATION • SEWAGE • CONSTRUCTION • MARINE • DEEP WELL • IRRIGATION • WASHING • COOLING • HOUSE and many other SERVICES IN INDUSTRY.

A distinguished line embodying the latest hydraulic practices—a type and size for every need.

Write for CONDENSED CATALOG M

Type OD Hor. Split Case, Double Suction Single Stage Centrifugal

NSA Aurora Centrifugal Sump Pump

APCO Single Stage Turbine-Type

Type GGU Side Suction Single Stage Centrifugal

The ONLY MOVING PART IN The APCO

APCO TURBINE-TYPE PUMPS—the simplest of all pumps. Ideal for small capacity, high head duties. Silent, compact and lasting.

APCO Horiz. Condensation Return Unit

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY

80 Loucks Street, AURORA, ILLINOIS

To Speed Victory!
WE ARE READY TO SERVE YOU!

"American"

COLD PIPE, CONDUIT and TUBE BENDING MACHINES

Twelve types to select from. Hand operated capacities ¼ to 6" inclusive. Motor operated ¾ to 8" inclusive.

A few of our more than 12,000 Customers: Kaiser Shipbuilding Co.; Bethlehem-Higham Shipyards; Portsmouth Navy Yard; Moore Drydock Co.; Stone & Webster Engineering Corp.; E. I. Du Pont de Nemours & Co.; West Penn Power Co.; Illinois Central Railroad; Federal Pipe & Supply Co.; Alabama Drydock Co.; Westinghouse Elec. & Mfg. Co.; Todd-Bath Shipbuilding Co.

Write Air Mail for printed matter.

"American" PIPE BENDING MACHINE Company INC

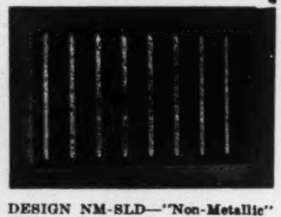
Quick Deliveries

51 PEARL ST.
BOSTON, MASS.

"NON-METALLIC" REGISTERS

FOR DEFENSE PROJECTS

Approved by Government Authorities for air-conditioning installations in Hospitals, Industrial Plants, Fortifications, etc., under Army, Navy or Maritime rulings. Field-tested STANDFORATED Register and Grille designs of durable, tempered Masonite are fabricated in standard sizes or to your specifications. Write for complete information.

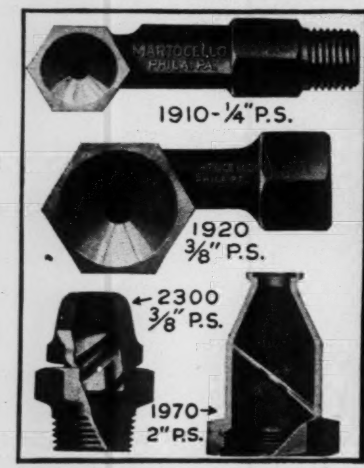


DESIGN NM-SLD—"Non-Metallic" Sliding Damper Foundation Vent.

STANDFORATED

FOR PRODUCTION SPEED-UP—
Specify Precision Processed STANDFORATED Perforations. Industrial Screens, Filters, Guards, etc., made to specifications for vital industries. Handy catalog sent on request.

STANDARD STAMPING & PERFORATING CO.
3151 W. 49th PLACE • CHICAGO, ILLINOIS

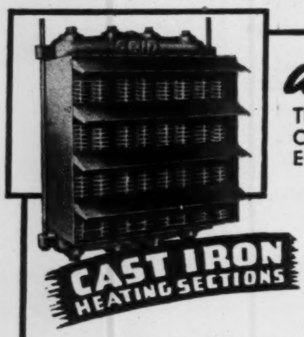


MARTOCELLO
SPRAY NOZZLES

Manufactured with precision and of a design which has been thoroughly tested for results and durability, they are guaranteed to give you satisfaction.

Successful efficient results depend largely upon selecting the proper number and type of Nozzle suitable for your installation. Consult with us.

Jos. A. Martocello & Co.
229-231 North 13th St., Phila., Pa.



D. J. MURRAY MFG. CO.
WAUSAU, WISCONSIN

a UNIT HEATER
THAT WILL LAST LONGER THAN OTHER TYPES OF HEATING EQUIPMENT—

DESIGNED and tested to operate with either steam or hot water—up to 250 lbs. steam pressure. Lower outlet temperatures . . . greater air volume . . . more air changes per hour . . . no electrolysis to cause corrosion. Each "fin" heating section cast in one piece of high test cast iron . . . no heating failures . . . no leaks . . . no breakdowns . . . no maintenance expense. Made in 9 sizes—Patent applied for. *Territory open for high grade distributors*

GRID UNIT HEATER

"CORROSION IN STEAM HEATING SYSTEMS"

PUBLISHED originally in serial form in HEATING, PIPING AND AIR CONDITIONING, this important treatise by Leo F. Collins and E. L. Henderson presents the results of fifteen years of intensive research into every phase of the corrosion subject.

The causes of corrosion in steam heating systems, where corrosion occurs in any system, and the best means of combating it are set forth in this paper in clear detail. Only a limited number of copies of this reprint are available. The price is 75c per copy. Send your order, with remittance, to the address below.

KEENEY PUBLISHING COMPANY
6 NORTH MICHIGAN AVE. CHICAGO 2, ILL.

MEETINGS & CONVENTIONS

National Safety Congress

National Safety Congress, October 5-7, Sherman, LaSalle, and Morrison hotels, Chicago, Ill. A labor and safety session on October 7 is a feature of the program. This is the annual convention of the National Safety Council, 20 N. Wacker Dr., Chicago 6, Ill.

Plumbing and Heating Industries

Plumbing and Heating Industries Bureau, annual meeting, October 14, Palmer House, Chicago, Ill., coinciding with the fall convention of the Central Supply Association. Arrangements are being made by a committee headed by Harry F. Beglen, American Radiator and Standard Sanitary Corp.

Welding Engineers

American Welding Society, 24th annual meeting, October 18-21, Hotel Morrison, Chicago, Ill., in conjunction with Wartime Emergency Metal Congress to be held at the Palmer House. Tentative program includes papers on investigation of a normalizing procedure to improve the grain structure of welds in carbon molybdenum pipe, by I. A. Rohrig, D. H. Corey, and Sabin Crocker, The Detroit Edison Co.; oxyacetylene distribution systems, by D. F. Guthrie and R. W. Stewart, Air Reduction Sales Co.; large welded pipe lines, by L. G. Christofferson, Chicago Bridge & Iron Co.; weldability of 27 per cent chrome steel pipe, by R. A. Mueller, I. H. Carlson, and E. R. Seabloom, Crane Co.; welded steel tubing quality control and application, by R. D. Malm, Clayton Mark & Co.; fabrication and welding of aircraft exhaust tubing manifolds and headers, by C. D. LaFond, Buhl Stamping Co.; metallic arc welded steel tubing, by W. T. Tiffin, University of Oklahoma; oxyacetylene tube welding, by A. C. Weber, Laclede Steel Co.; inspection of arc welding for pressure vessels and piping, by W. D. Halsey; and war emergency codes for welded pressure vessels, by E. R. Fish, Hartford Steam Boiler Inspection & Insurance Co. Headquarters office of the American Welding Society is at 33 W. 39th St., New York 18, N. Y.

Industrial Health Short Course

School of Public Health, University of Michigan, in-service training course for plant safety personnel, October 19-21, Ann Arbor, Mich., given at the request of the Michigan Industrial Association. Program includes discussions of control of solvent vapors and acid mists; control of smokes, fumes, and gases; evaluation and control of dusts; industrial ventilation practices; how to make a survey for health hazards; and others. For further information, write H. E. Miller, School of Public Health, University of Michigan, Ann Arbor.

Industrial Hygiene Foundation

Industrial Hygiene Foundation, eighth annual meeting, November 10-11, Mellon Institute, Pittsburgh, Pa. "Practical, workable measures for the health maintenance of men and plants" will comprise the program. Managing director of the IHF is John F. McMahon, 4400 Fifth Ave., Pittsburgh, Pa.

Heating and Ventilating Engineers

American Society of Heating and Ventilating Engineers, 50th annual meeting, January 31-February 2, Hotel Pennsylvania, New York City. A special program dealing with the past, present, and future is being planned. Secretary, A. V. Hutchinson, 51 Madison Ave., New York 10, N. Y.

What's Behind the Trade Mark?

QUALITY

TRADE MARK

YOUNGSTOWN

SERVICE

Strength for a National Emergency

IN the period of World War I, The Youngstown Sheet and Tube Company "came of age."

1915 began in depression--with fear and uncertainty at home and abroad. But that courage and vision which built Youngstown into a $20,000,000 corporation in 15 years, now brought a 50% increase in capital stock and a huge construction program. The next three years saw a modern, integrated plant completed--3 new open hearths, another blast furnace, batteries of coke ovens, additional finishing mills, new laboratory, hospital, works office building, hundreds of homes for employees. When war ended, nearly $39,000,000 of stockholders' money had been plowed into plant and facilities.

The decision to expand was timely. French and British orders came with a rush in mid-1916. After April 1917, America and her Allies demanded and received every possible pound of steel to win the war.

In those events we see a familiar pattern--tremendously increased production, labor scarcity, high wages, taxes taking 80% of profits. But fortunately the American system of private enterprise was enabling Youngstown to earn good profits--sufficiently high to pay off all its bonded indebtedness, to pay generous dividends to stockholders and to fortify itself with reserves which enabled it and its employees to survive the lean early '20's.

Free enterprise, which made the steel industry strong, won that war for America and democracy, and built the business system on which we must depend for national survival today

Historical Series - - - No. 7

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Tin Plate
Rods - Wire - Nails - Tie Plates and Spikes - Alloy and Yoloy Steels

"We're Busy NOW"

Building:

John Zink Burners for plants making 100-octane Gasoline, Toluene, Styrene, Butadiene, Magnesium, Aluminum, . . . and many other Warfare Products

and John Zink Floor Furnaces for Defense Housing Projects only . . .

BUT

after the war is won we shall again manufacture that Amazing

JOHN ZINK
FLOOR FURNACE
for everybody

Complete foundry, specializing in small complicated iron castings.

"JOHN ZINK
Products Must Be Good"

Write for Details Now!

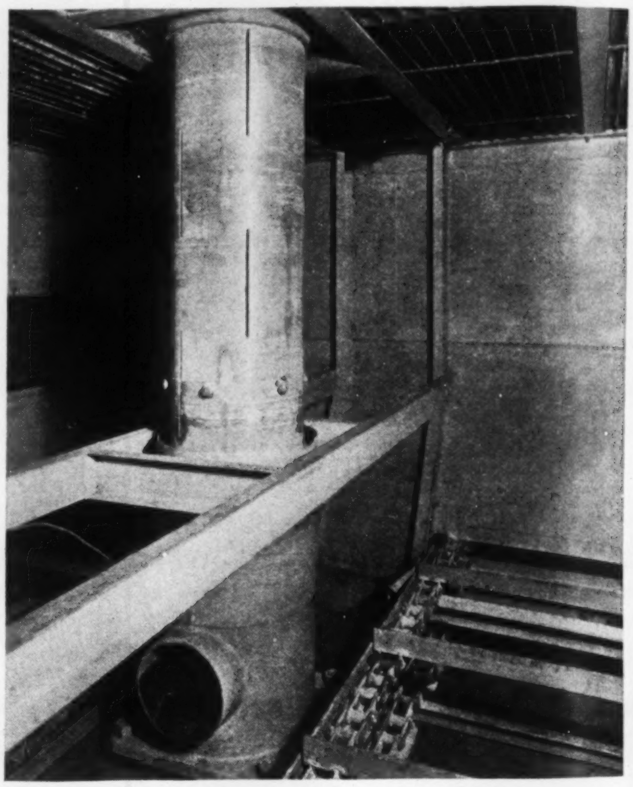
John Zink Co.
TULSA, OKLAHOMA

Nek York • Los Angeles • Detroit • San Francisco

The water is broken up into countless small globules, which are whirled from ports in the rapidly revolving cylinder into and through the air stream. This dense, high velocity spray covers the entire area of the washing chamber, through which the dustladen air is forced to pass. With this method, the dust particles are brought into contact with a maximum water surface, thereby obtaining high cleaning efficiency.

Through production of globules rather than a spray of mist, objectionable evaporation is avoided. By thus controlling the evaporation, the humidity is maintained within satisfactory working limits, says the manufacturer.

The air is taken into the washer through two inlets, one on each side of the machine. These are so arranged that the direction of the air flow is down near the sides to the surface of the water in the tank, where the larger particles are removed. It then passes through a grid which is continuously washed by the spray from the cylinder. At this point in the operation considerable washing of the air is effected. From here, the air passes into the washing chamber where it is subjected to the whirling action of the water discharged from the cylinder. Here it is thoroughly washed; the foreign matter falling to the pump tank with the descending water. After the final wash, the air passes through the moisture eliminators, and from there it is removed from the machine by the fan.



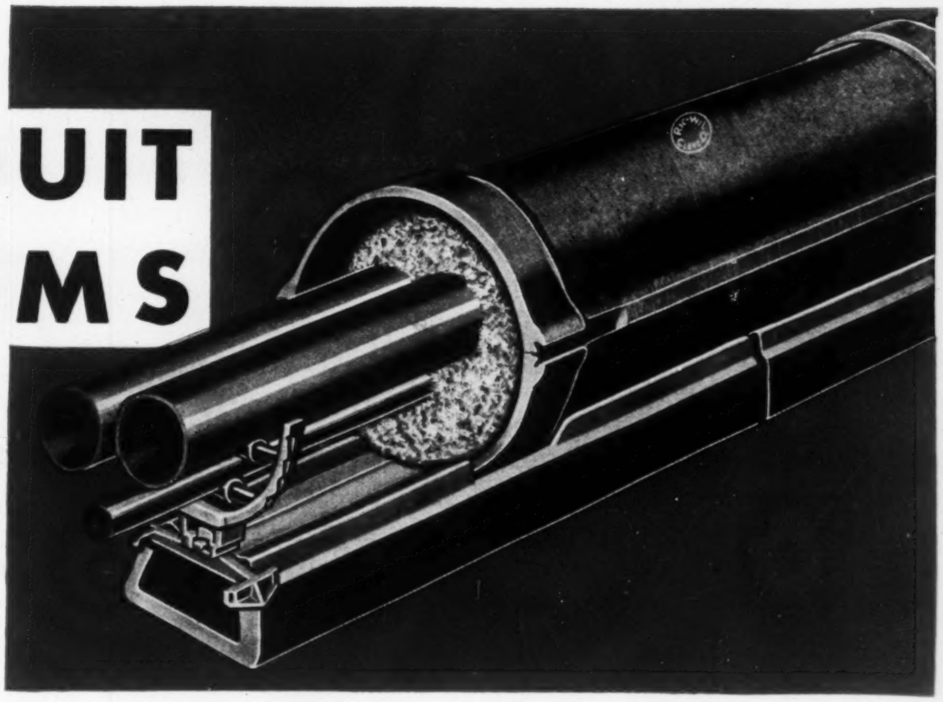
One of the photos shows an interior view of the washing chamber and revolving cylinder. The other picture shows a group of surface grinders in the plant, with their exhaust ducts.

The heat loss due to the removal of large quantities of air from within the building in the winter time amounts to a considerable item; therefore, the decision was made to return the washed air back to the building. A discharge duct system returns the air to various points inside the building so as to avoid unnecessary drafts and air blasts.

This installation is not one where the air is fully conditioned. No provision has been made for humidity or temperature control in the "Centri-Spray" system itself. Normally a temperature decrease of from 7 to 12 F in the air passing through the machine is obtained with only a moderate increase in the humidity.—Centri-Spray Co., 14290 Meyers Rd., Detroit, Mich.

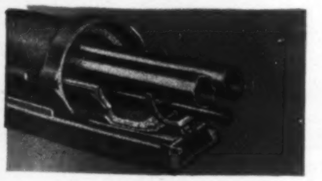
TILE CONDUIT SYSTEMS

FOR UNDERGROUND STEAM LINES



Ric-wiL, pioneer in the tile conduit field, has served the country's needs on underground steam protection with outstanding leadership since 1910. Today, with material supply, production facilities, and plant personnel subjected to severe pressure, it is a point of pride with us that traditional standards of quality are being scrupulously maintained. In spite of heavy demands, we are well equipped to make quick deliveries on all sizes and types of Ric-wiL Tile Conduit, as well as on our complete line of Prefabricated Insulated Pipe Units . . . Conduit illustrated is Ric-wiL Standard Tile with filler insulation. Heavy duty Super-Tile and Cast Iron are also available for this type, and all are adaptable to single or multiple pipe systems.

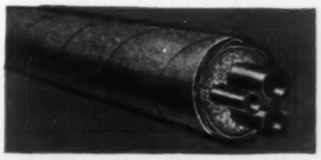
RIC-WIL TILE CONDUIT FOR OIL OR PROCESS LIQUIDS



In this system, conduit is insulated from the exterior, but individual lines are not insulated from one another. A steam or hot water line can thus maintain temperature to keep liquids flowing in the other lines. Insulation is a diatomaceous earth lining, moulded and keyed to inside circumference of tile. May also be used with fibre insulation for steam heat, power and superheated steam. Applicable to Super-Tile and Cast Iron.

RIC-WIL PREFABRICATED INSULATED PIPE CONDUIT

Completely factory-prefabricated units including pipe and insulation as specified are furnished in convenient 21 foot lengths for speedy installation. Conduit is helical corrugated, coated with asphalt and wrapped with asphalt-saturated asbestos felt. This system is also available for oil or process liquids, and is adaptable to overhead as well as underground installations.



Many other types of Ric-wiL conduit are available to meet individual requirements. Write for complete information.

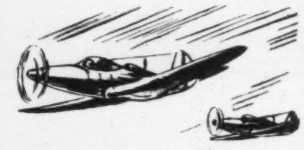
RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

MEN

INDUSTRIES

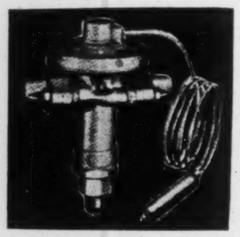
NATIONS

Depend on REFRIGERATION accurately controlled . . .



One reason for America's superior might in weapons of war is Industry's new achievements in mechanical perfection. . . . Working in accuracies of ten-thousandths and millionths of an inch—on a production-line basis. Such accuracies were so minute that parts could be assembled only after they were subjected to shrinking or contraction by specially built Refrigeration units under controlled temperatures. . . . Another vital service of Refrigeration-at-war.

Here, as in all other phases of Refrigeration, the precision-control knowledge and experience developed at A-P is offering ready assistance, in more accurate and DEPENDABLE Refrigerant Control. Pacing new developments in the field, A-P Research Staff is already working with many manufacturers on post-war products that promise new and greater use for Refrigeration. This is a service YOU may be able to profitably use on your new plans!



AUTOMATIC PRODUCTS CO.

2460 N. Thirty-Second St.
Milwaukee 10, Wisconsin

DEPENDABLE
REFRIGERANT VALVES

Stocked and Sold by Jobbers Everywhere

Automatic Valve Feature of Self-Priming Pump

No. 2511—An improved automatically controlled valve is a feature of the new "Type AO" self-priming pump announced last month. The design and operation of its valve arrangement is an important factor in the quick and effective self-priming action of this pump, says the manufacturer.

Priming of the pump is accomplished as the motion of the water throughout the pump runner and the volute passage carries behind it a slug of air, drawing air in the suction passage through the impeller and out through the priming chamber. This hydraulic action lifts the column of water in the suction line and achieves the same results as would a separate vacuum pump. The priming valve closes slowly during this process, acting against a spring tension which governs the rate of priming and the static height of the priming suction lift. The automatic closing of the valve after complete priming prevents water from bypassing back to the suction chamber, with resultant power loss.

The pump impeller has an unusually thick vane with rounded inlet edges, permitting the pump to pass stringy materials and fairly large solids, it is stated.

A complete line of this pump, from 1 to 6 in. size, is planned, although only 2 and 3 in. sizes are ready for immediate sale. The entire line of pumps will range from a very small capacity to 1400 gpm and up to heads of 100 ft or over. The priming device incorporated in these pumps is also adaptable to use with other pumps, particularly the single suction type.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

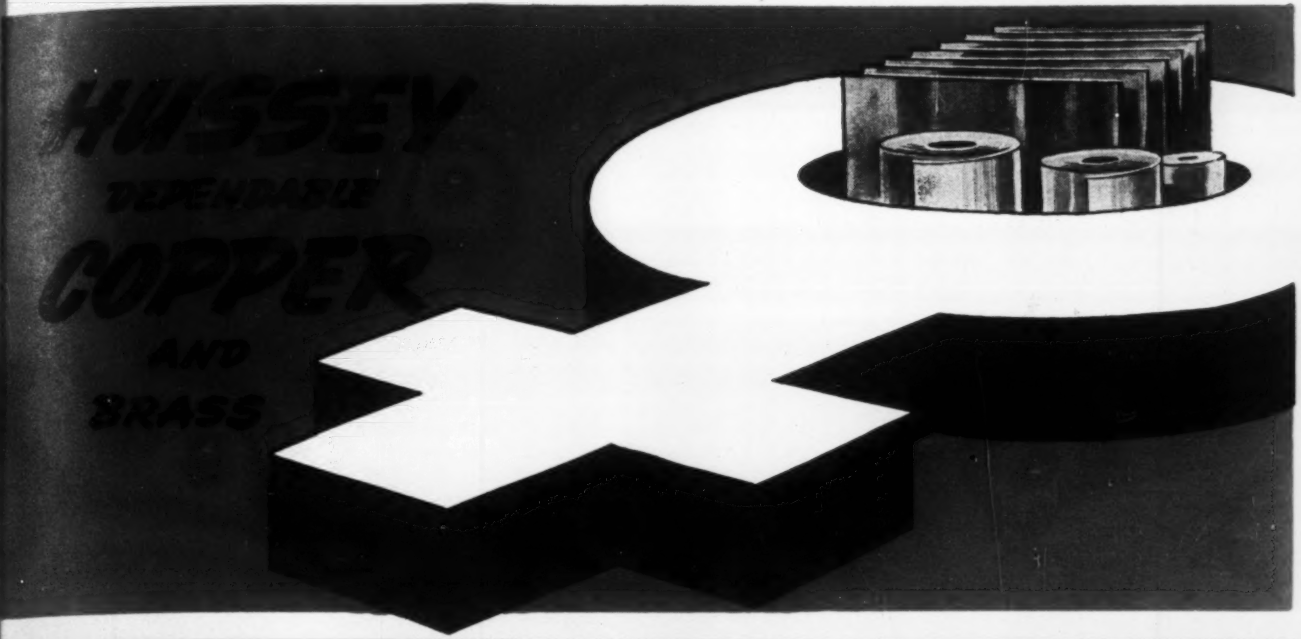
Electronic Time Relay

No. 2512—A recently introduced line of adjustable electronic time relays are built to control industrial processes in which extreme accuracy and dependable performance are required. These relays combine two hermetically sealed units, both of which are safe in explosive and corrosive atmospheres, says the manufacturer. The load is carried by a quick acting mercury relay.

Standard models cover time ranges from 0.05 to 0.5, 0.10 to 10, and 1 to 100 sec., respectively. Special models can be produced up to 5 min. Contact capacities are available up to 75 amp, either normally open or normally closed.—Durakool, Inc., 1010 N. Main St., Elkhart, Ind.

Bender for Marine and Aircraft Use

No. 2513—The "Di-Acro No. 3" bender illustrated here was developed especially for aircraft and marine work because of a demand for a bender capable of forming greater diameters than is possible with the manufacturer's smaller models. The picture shows the forming of a pipe support with this machine—a 7 in. circle and two right angle bends are all being obtained in the one operation.



A GOOD NAME TO REMEMBER IN YOUR POST-WAR THINKING FOR THESE AND HUNDREDS OF OTHER SIMILAR APPLICATIONS

Agriculture Implements
Aircraft & Parts
Business Machines
Cars & Trucks, Industrial
Cars, Electric & Steam
Clocks, Watches
Communication Equipment
Dental Equipment
Electrical Equipment
Engines, Turbines
Firearms
Fire Extinguishers
General Machinery
Hardware
Heating & Cooking Apparatus
Instruments
Laundry Equipment
Lighting Equipment
Locomotives
Machine Tools
Mechanical Power Trans. Equip.
Mining Equipment
Motorcycles, Bicycles, & Parts
Motor-Vehicles & Parts
Oil Burners
Oil Field Equipment
Photographic Apparatus
Printing Machinery & Equipment
Pumps & Equipment
Radio & Phonograph Apparatus
Refrigeration & Air Conditioning
Safes & Vaults
Scales & Balances
Sewing Machines
Ship Building & Repairing
Soda Fountain Equipment
Stokers, Mechanical
Textile Machinery & Parts
Tractors
Woodworking Machinery
X-Ray & Therapeutic Apparatus

and hundreds of other similar applications where the corrosive action and easy workability and dependability of copper and brass are essential.

HUSSEY

C. G. HUSSEY & COMPANY
(DIVISION OF COPPER RANGE CO.)
Rolling Mills and General Offices: Pittsburgh, Pa.
Warehouses in Principal Cities

BARBER-COLMAN

GRILLES & REGISTERS
AIR DIFFUSERS

ENGINEERED
venturi-flo
OVERHEAD AIR DIFFUSERS
AIR DISTRIBUTION

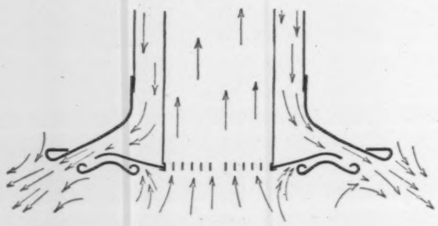
AUTOMATIC
CONTROLS

COMBINATION

SUPPLY and EXHAUST

venturi-flo

AIR DIFFUSERS



CROSS-SECTION. This drawing, with arrows indicating the air paths, shows the construction of this type of VENTURI-FLO Air Diffuser. The exhaust duct is connected to the center section having a concentric ring grille. The supply duct surrounds the exhaust duct and is connected to a collar on the largest plate.

★ **CANNOT SHORT-CIRCUIT.** As shown in the drawing, the incoming and outgoing air streams are so nearly at right angles that supply air is not sucked into the exhaust duct.

★ **LOW PRESSURE DROP.** Contours of the distribution plates were experimentally determined to provide minimum resistance to air flow, quiet air delivery, and a "venturi" action to produce desired diffusion.

★ **GUARANTEED AIR DISTRIBUTION.** From comprehensive laboratory and service test data, exactly the proper unit for any conditions can be selected, and *satisfactory results guaranteed.*

BARBER-COLMAN COMPANY 1228 ROCK STREET
ROCKFORD, ILLINOIS

In aircraft work, chrome molybdenum and heat trea aluminum alloy materials in tube and round, square, flat outline "are readily formed by this bender to prede mined radii." In marine and ship construction pipe str hooks, brackets, clamps, offsets, and supports for ma subassemblies and construction parts can be comple fabricated in one or two forming operations with this m according to the manufacturer. Electrical and panel c trol board wiring assemblies can be duplicated in quanti —O'Neil-Irwin Mfg. Co., Inc., 316 Eighth Ave., S., Min apolis, Minn.

Coal Chutes of Glass

No. 2514—One of the glass coal chutes at the Locust Coal Co.'s breaker at Shenandoah, Pa., is illustrated here, and H. B. Weed displays a section of Carrara glass used in the chute.

Five glass chutes are now in use in the breaker, the original installation having been made in May 1942. Although carrying an average daily load of 100 tons, there has been no breakage, there is very little sign of wear or abrasion, and indications are that the glass will last indefinitely, says its manufacturer. — Pittsburgh Plate Glass Co., 2000 Grant Bldg., Pittsburgh, Pa.

New Group of Synthetic Plastics

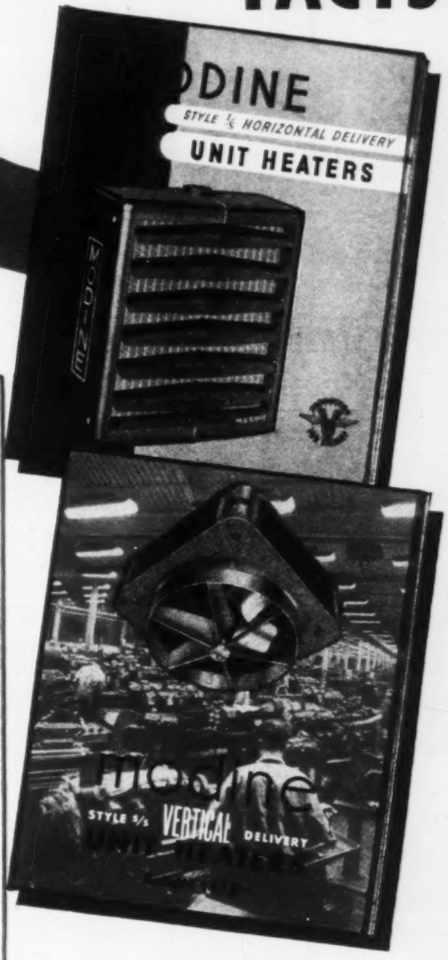
No. 2515—A new name to add to the growing list synthetic plastics is "compar"—a group of coal, limest and air derivatives which might be called the missing l between plastics and synthetic rubber—notable (says manufacturer) for unparalleled immunity to the new, h to handle aviation "superfuels." The development of almost endless chain of compar variations grew out of demand by warplane designers for a flexible material handle toluol, xylol, and benzol.

The compars are described as "transparent, flexible, r berlike plastic materials, five to 20 times more wear sistant than natural rubber, and the most solventpr rubber substitute yet developed." Some of the compars already in use in warplane fuel and hydraulic hose, di engines, chemical warfare equipment, in gyropilots, and the form of protective gloves, aprons and shoe coatings workers exposed to irritating petroleum solvents. So of other war uses are said to be in the development st while many postwar uses are expected.

The name "compar" is used to distinguish between

THESE BOOKS GIVE YOU THE FACTS

FIND OUT . . .
HOW



Get Bulletins 143-A, 143-B

modine
UNIT HEATERS

- ✓ **protect manpower**
- ✓ **save fuel** ✓ **save space**
- ✓ **cost less to install and less to maintain**

With manpower dwindling to the older and less physically fit ...war plants are hiring more and more women. Industry must take every practical step to protect workers' health and morale. Show them how to do it with Modine Unit Heaters ...and protect plant production at the same time.

Thermostatically controlled, Modines *automatically* maintain *even temperatures.* Workers are less susceptible to colds. No chilling drafts stiffen their muscles or numb their hands and feet. They're more alert, make fewer mistakes, do more work ... absenteeism is lessened.

Modines use less fuel. Individually controllable, Modines go on and off like a light. No wait for warm-up; no over-run when right temperature is reached. No heat is wasted. Fuel saving—as much as 25% over cast iron radiation.

No floor space which can be used for production is taken up by Modines. With *Modine-patented* direct-from-branch-supply-pipe suspension, supply connection is only support needed. No brackets, rods or straps. Less material, less labor —$3 to $8 less cost per unit to install.

Preventive maintenance is a built-in feature—Modines are engineered for 3-shift operation.

ARMY E NAVY

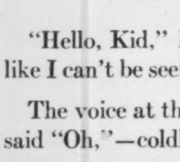
HOW YOU CAN GET modine UNIT HEATERS

On an order carrying a priority rating of AA-5 or better
OR
on a repair order—"MRO"—for instance

Look in your phone book for Modine representative's name—"Where to Buy It" section.

MODINE MANUFACTURING COMPANY, 1772 RACINE STREET, RACINE, WISCONSIN

Why Jimmy's girl sees him oftener now...



JIMMY FROWNED as he picked up the phone and dialed his number.

"Hello, Kid," he mumbled, "it looks like I can't be seein' you tonight either."

The voice at the other end of the wire said "Oh,"—coldly.

"Look" said Jimmy, "it's that darn strip coiler. The motor quit again this afternoon, and the boss says we'll have to work late and replace it . . . "

This little story could have several endings. But, in the case of a large aluminum company where Jimmy worked, the facts are these:

To prevent strip coiler motors from overheating, a constant current of air was kept blowing across the armatures. But, plant engineers and machine operators discovered, to their dismay, that manufactured dusts and grime in this cooling air were too frequently getting inside the motors and causing failures.

To overcome this condition, the engineers installed Dust-Stop* Filters in the air duct opening behind each motor. Result: Clean dust-free air now helps keep the strip coilers on the job all day—every day . . . producing aluminum at peak capacity.

So, Jimmy's girl sees him oftener now.

* * *

Today's heavy war production requirements have brought to light many new uses for Dust-Stop Air Filters.

These filters are being used in tool grinding machines, portable radio transmitters, paint-spray booths, welding unit and electrical-equipment installations. They are removing manufactured dusts in assembly and precision-parts operations . . . in factories, laboratories, and drafting rooms.

For complete engineering and installation information about Dust-Stops write to *Owens-Corning Fiberglas Corporation, Toledo 1, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

ARMY NAVY

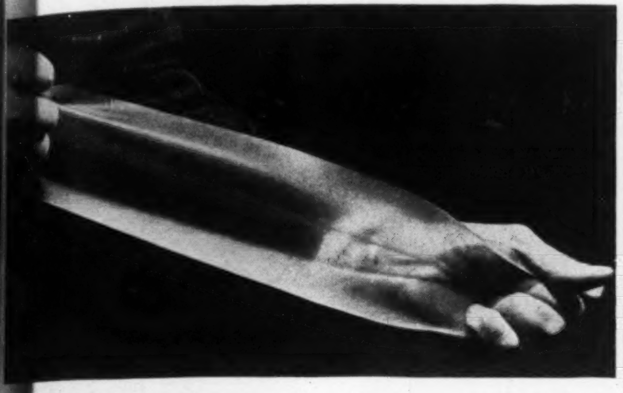
FIBERGLAS*

DUSTOP

*T. M. Reg. U. S. Pat. Off.

AIR FILTERS

basic polyvinyl alcohol resins, which are water soluble powders, and the many derivatives, compounds and modifications which have physical properties entirely unlike the original resin. The name of these latter materials derives from the letters in the words "compounded polyvinyl alcohol resin."



This new plastics group is noted for pronounced flexibility, toughness, and abrasion resistance, says the maker. Some types of compar are not only resistant to, but chemically entirely unaffected by, the action of organic solvents including the aliphatic and aromatic hydrocarbons, the chlorinated hydrocarbons, the ketones, etc. Others exhibit very low permeability to industrial, refrigerant, and military gases; high tensile strength; and freedom from ageing or oxidation. Some varieties will remain flexible at temperatures as low as —70 F or as high as +300 F. Others have been so modified as to be insoluble in water at all temperatures, with swelling limited to 10 per cent and water absorption to about 15 per cent.

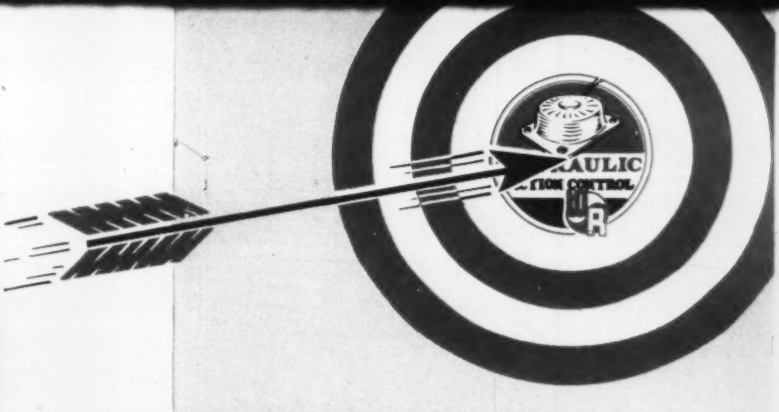
One of the major applications for compar is in the construction of hose and hose assemblies. High octane aircraft gasolines containing up to 40 per cent or more of aromatic hydrocarbons must be handled; diesel fuels may not be contaminated by fuel line erosion; fine orifices or delicately balanced parts of hydraulic mechanisms or lubricating systems must not become gummed or clogged due to attack by the hydraulic or lubricating oils on the inner wall of the hose; flexible nonmetallic conduits must carry refrigerant or other gases without leakage. Moreover, all of these difficult tasks must be performed regardless of the scalding heat of the desert or the searing cold of the stratosphere.

Transparent tubing, also made of compar, affords the laboratory worker, doctor, dentist, or other scientist a new flexible conduit. It can be used in contact with many liquids which seriously attack or deteriorate rubber or the various synthetic rubbers. A further advantage lies in its real imperviousness to gases, says the manufacturer.—Resistoflex Corp., Belleville, N. J.

Centrifugal Refrigeration for Ships

No. 2516—Six new freighters have been converted to refrigerated "reefers" and are now in service carrying frozen meat for allied forces abroad. The cargo space is divided into two separately insulated cargo spaces which together have 14 compartments, each compartment being maintained at a minimum temperature of 15 F.

Centrifugal refrigerating machinery operated directly by its own steam turbines from the ships' steam boilers has been installed to provide necessary flexibility and to conserve shipping space and weight. This is believed to be the first time cargo vessels have been equipped with centrifugal compressors for cargo refrigeration. This type of refrigeration has been used previously on shipboard only to a limited extent on luxury liners for comfort cooling. Two compressors are installed on each ship, to provide the maximum amount of refrigeration needed, one of which is a spare.—York Corp., Roosevelt Ave., York, Pa.



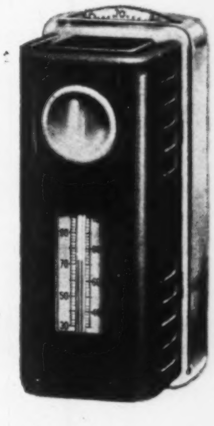
ACCURATE
CONTROL!

If your post-war product or service requires accurate temperature control it will pay you to know that the White-Rodgers Hydraulic-Action principle provides dependable accuracy regardless of:

- **Changes in ambient temperature.**
- **Changes in altitude.**
- **Off-level mounting of control or its sensitive bulb.**

Today the White-Rodgers Hydraulic-Action principle of temperature control is at work for the Army, the Navy, and firms engaged in essential wartime activities. Tomorrow its advantages will again be available for peacetime service.

Consult us on your post-war control problems and we'll gladly show you how Hydraulic-Action can be applied.

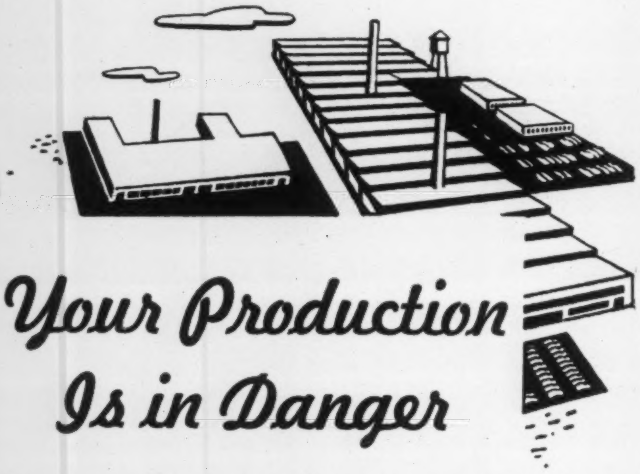


SERIES 150

Heavy duty line voltage room thermostat for use on unit heater and air conditioning installations. No relay necessary on most installations.

WHITE-RODGERS ELECTRIC CO.
1205k CASS AVE. **ST. LOUIS, MO.**

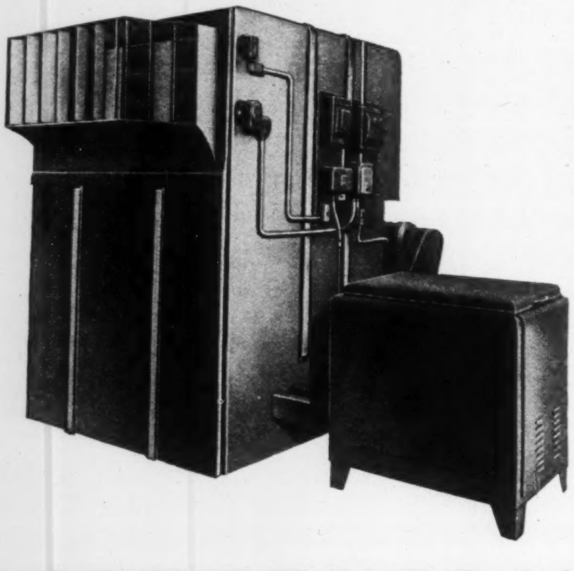
Controls for Heating • Refrigeration • Air Conditioning



Your Production Is in Danger

Shivering employees in cold, drafty rooms cannot work at top speed and accuracy. Install a Directherm Unit Heater. It will keep your plant warm—EVENLY warm—and the morale up. Absentee sickness costs many times more than a Directherm.

It Is Not too Late for This Winter
If You Order Immediately



DIRECTHERM UNIT HEATERS

Made in six sizes (300,000—1,700,000 BTU). For coal, gas, and oil. No pipe or duct work. Easy installation. Automatic controls. No maintenance.

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. ST. LOUIS 10, MO.

Conserve Fuel NOW with Sterling THERMOTROL RADIATOR CONTROLS

(Released from Priorities under amendment to W.P.B. Order L-79)

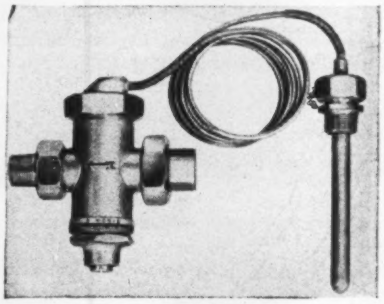
All owners and users of heating systems employing hot water, steam, vapor and vacuum are now free to enjoy the FUEL SAVING BENEFITS of Sterling THERMOTROLS—automatic radiator controls . . . savings which in the past have ranged upwards to as much as 25%!

THERMOTROLS, completely self-contained, thermostatically operated, are easily installed on each radiator. Set to any desired degree of heat, they automatically maintain steady, comfortable room temperature, prevent costly overheating.

Conserve vital fuel! Equip ALL your radiators with TERRMOTROLS NOW! Available for concealed or exposed radiators, for two-pipe steam, vapor and vacuum systems, and one or two-pipe hot water systems. Write for Bulletin 401.

STERLING THERMOTROL

For Liquids and Processing



Self-contained, self-operated, this Thermotrol maintains accurate temperatures for more efficient and economical operation of hot water storage tanks, heat exchangers, process cookers and sterilizers. Available without priority for pressures to 125 lbs. temperature ranges to 300° F. Write for details.

STERLING, INC.
Sales Office: 4015 N. Oakland Avenue
Factory: 3738 N. Holton Street, Milwaukee, Wisconsin

Manufacturers of a Complete Line of Heating Pumps . . . Temperature Controls . . . Heating Specialties

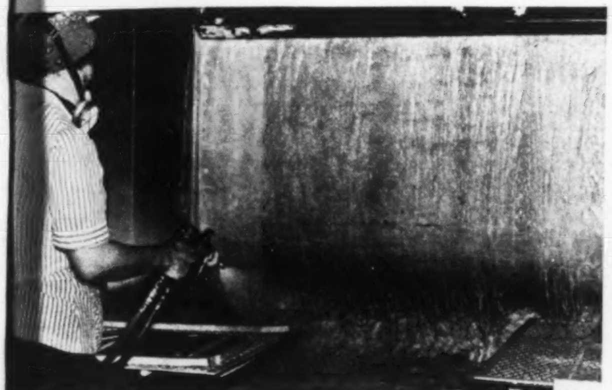
otary Hand Pump for High Pressures

No. 2517—An all bronze rotary hand pump that develps a pressure of 125 psi and has a capacity of 1.5 gpm known as a "dead ship starting pump." It is also used r other high pressure hand pump applications aboard ip, such as handling certain types of lube oils and fuels. According to the manufacturer, this new pump has, in dition to its marine uses, a number of industrial and mmercial applications, chiefly in connection with hyaulic control devices and other equipment where high essure, hand operated pumping units are required.—lackmer Pump Co., 1920A Century Ave., S. W., Grand apids 9, Mich.

ater Treatment Aids Paint Recovery

No. 2518**—A new use in paint recovery was discovered cently for a chemical compound deflocculator, according the manufacturer.

Paint overspray collected from water wash curtain spray ooths which used circulating water treated with the deocculator lent themselves better to recovery and produced recovered paint of the highest quality, according to test uns.



When the deflocculator was originally developed as a emical treatment for circulating water systems in paint pray booths, its sole purpose was to prevent breaks in the ater curtain by emulsifying oil and resinous vehicles and ispersing pigments so that they could not deposit on the etal walls of the spray booth. It also serves as a chemical covery agent. By preventing the formation of scum on e top of tanks, it aids in producing a higher quality of udge which stays smoother and is dispersed easier after claiming, says the manufacturer.—Turco Products, Inc., 35 S. Central Ave., Los Angeles, Calif.

rc Welding Ship Ventilators

No. 2519—One would hardly think of a showcase manucturing company changing over to cowl ventilators for hips, but that is what Weber Showcase and Fixture Co. as done.

A swift and sure method of producing these ventilators as the first and most important problem. A large deep rawing press, weighing 250 tons and standing four stories igh, was designed and built by arc welding. When forgngs for the four corner posts were not available and devery of specially made forgings could not be assured in he allotted time, arc welding for the fabrication, using column construction, with structural steel, was used to liminate need for forgings.

After the blanks for the ventilators are cut and drawn he two halves of the ventilator are arc welded together, ottom and face are trimmed, and collars are rolled and elded for the vent. Here again, a little experimentation evealed a shortcut of the more obvious process of using lotted pipe. A series of roller dies which would form 11 ga teel ribbons into the desired shape was constructed. Six

BE A FREEMAN STOKER DEALER...DO YOUR PART TO SPEED THE NATIONAL

FUEL CONSERVATION PROGRAM

HELP THE WAR EFFORT . . .

BUILD A PERMANENT, PROFITABLE STOKER BUSINESS

at the same time!

Your government has asked your help in conserving a minimum of 6 million tons of coal annually through the installation of stoker equipment in hand-fired plants which burned more than 40 tons of coal last heating season! It is essential to the war effort that this vital fuel be saved. *Do your part by speeding these conversions with Freeman Long-Life Stokers.* They have proved their superior efficiency and economy in thousands of installations throughout the world . . . are manufactured by a pioneer leader in the stoker industry, rated AAA 1, established 1864. No other wartime service enables you to cooperate so effectively with the government's fuel conservation program; no other company offers you such an outstanding opportunity to develop a permanent, profitable stoker business. Write today for complete details on our aggressive promotion program that means essential help for Uncle Sam . . . sales-winning success for you!

FREEMAN STOKERS

FIRST CHOICE OF AMERICA'S FOREMOST HEATING ENGINEERS

★ PROMPT DELIVERY

Complete Range of Sizes:
65 to 1200 Pounds Per Hour

GET THE FACTS! MAIL THIS COUPON TODAY!

FIRM NAME__________

YOUR NAME__________

ADDRESS__________

CITY__________ STATE__________

BUY WAR BONDS AND STAMPS

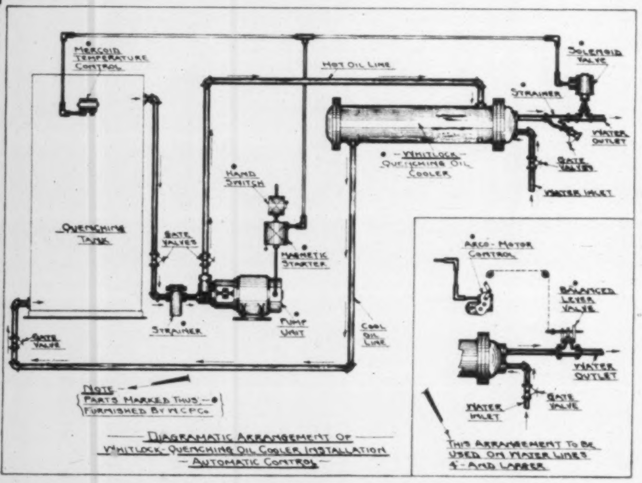
FREEMAN STOKER DIVISION
ILLINOIS IRON & BOLT CO.
GENERAL SALES OFFICES: 918 S. MICHIGAN AVENUE, CHICAGO 5, ILLINOIS

WHITLOCK

QUENCHING OIL COOLERS

CUT WATER COSTS

The modern method of keeping quenching oil uniformly at the correct temperature in the heat treatment of steel—and the most successful, practically and economically—is to circulate quenching oil from the top of the tank through a WHITLOCK Quenching Oil Cooler and back to the tank again. Because of its efficiency, this method consumes a minimum of water and is, therefore, particularly economical for use in plants dependent upon municipal water supplies.


MERCOID TEMPERATURE CONTROL
HOT OIL LINE
SOLENOID VALVE
STRAINER
WATER OUTLET
WHITLOCK QUENCHING OIL COOLER
GATE VALVES
WATER INLET
HAND SWITCH
QUENCHING TANK
GATE VALVES
MAGNETIC STARTER
STRAINER
PUMP UNIT
COOL OIL LINE
GATE VALVE
NOTE PARTS MARKED THUS — ● FURNISHED BY W.C.P.Co.
DIAGRAMATIC ARRANGEMENT OF WHITLOCK QUENCHING OIL COOLER INSTALLATION — AUTOMATIC CONTROL —
ARCO-MOTOR CONTROL
BALANCED LEVER VALVE
WATER OUTLET
GATE VALVE
WATER INLET
THIS ARRANGEMENT TO BE USED ON WATER LINES 4" AND LARGER

WHITLOCK Quenching Oil Cooler can be located out of the way with circulating pipes running to the various quenching tanks as shown above.

Write for our chart K-300, for determining the optimum size of Quenching Oil Cooler for any given conditions.

The WHITLOCK MANUFACTURING COMPANY

44 South St., Elmwood, Hartford 1, Conn.

District Offices in: New York Boston Chicago Philadelphia Detroit Richmond

---

WORKMEN LONG SKILLED IN THEIR ART...

. . . Build Adsco heaters to your order

The difference between a heater that has the capacity, efficiency and reserve factors exactly suited to your requirements depends upon its design. The way that heater stays put — provides years and years of trouble-free service depends on how it is built.

This is why America's largest industries — shipbuilders — institutions — Army and Navy look to ADSCO for heaters — horizontal or vertical — storage or instantaneous — heat economizers or special equipment to heat or cool water, oil or other liquids. Submit details of your heating or cooling problems or write for bulletin 35-75HP.

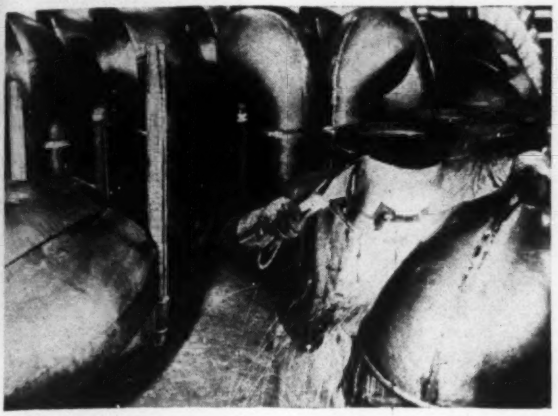
AMERICAN DISTRICT STEAM COMPANY
N. TONAWANDA, N. Y.
MAKERS OF "UP-TO-DATE" STEAM LINE EQUIPMENT
FOR OVER 60 YEARS

ADSCO HEATERS

Are built just right for the job

STORAGE AND INSTANTANEOUS HEATERS
ECONOMIZERS • HEAT OR COOL WATER
OIL OR OTHER LIQUIDS

sets of rolls driving from the same gearing progressively squeeze the steel ribbon into pipe with a ⅛ in. slot. This results in a straight pipe to be rolled into a circle, causing the slot to close. Arc welding closes the loop. Next, the welded ring is rolled over a tooth which opens the slot once more. The strengthening ring now is driven with a hammer slotwise over the edge of the ventilator and arc welded in place. Incidentally, this yields an excellent joint whose remaining cracks and crevices fill with hot zinc during galvanizing.



Similarly, a band of steel measuring ½x2 in. is rolled and welded closed, slipped over the sleeve of the funnel, and arc welded. This band not only strengthens the structure as a whole, but readies the sleeve for attachment to the funnel proper at a later time. Welding the vent to the funnel may take place in the plant or at the shipyard.

When the funnel is complete, the weld and bead are ground and sandblasted preparatory to obtaining maximum results from the galvanizing job. Finally screens are installed, thus serving the dual purpose of collecting debris and breaking the force of water when the ships are plowing through heavy seas.—Hobart Brothers Co., Troy, Ohio.

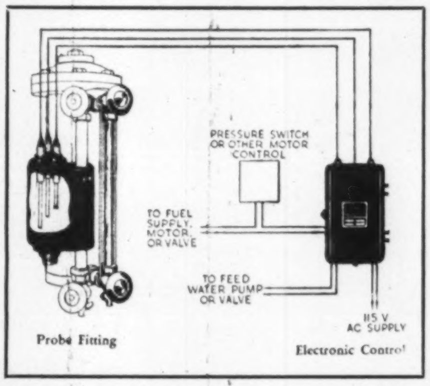
Stockroom Bin Card Holders

No. 2520 — Stockroom bin card holders made of ivory plastic are available in widths of ⅝, ⅞, and 1-7/16 in. and may be had in 3, 4, or 5 in. lengths.

Applicable to any flat surface—on wood by means of tacks, for which holes are provided, or on metal with glue —they consist of the plastic holder itself, an insert tab on which description of the article may be typed, and a covering sheet of transparent plastic.—Plastic Div., Hollywood Athletic Co., 211 E. 7th St., Los Angeles 14, Calif.

Electronic Control Regulates Boiler Feedwater

No. 2521**—"Fireye" electronic feedwater controls for maintaining constant boiler water levels automatically, and for guarding against low water hazards, were designed to provide the average plant with low cost automatic control, and eliminate difficulties encountered with complicated mechanical devices, says the manufacturer.


PRESSURE SWITCH OR OTHER MOTOR CONTROL
TO FUEL SUPPLY, MOTOR, OR VALVE
TO FEED WATER PUMP OR VALVE
115 V AC SUPPLY
Probe Fitting
Electronic Control

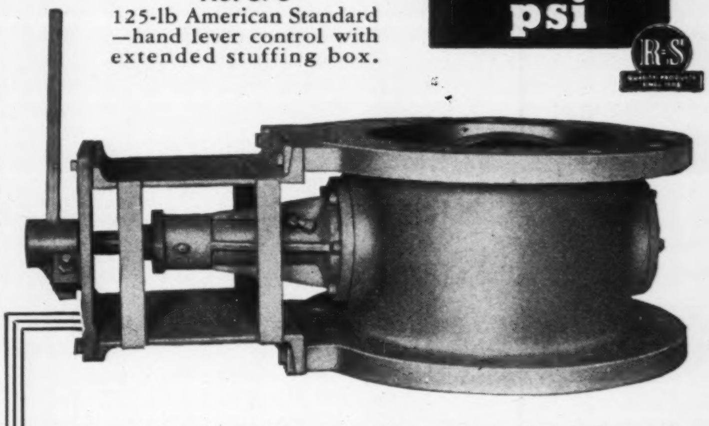
For automatic feedwater pump control and low water protection, this control is used with a probe fitting which may be mounted parallel to the water column, or directly on the boiler, and is wired to the electronic control. Three probes within the fitting mark boiler feedwater pump

Wide Range of Operation

15 to 900 psi

R-S

No. 573
125-lb American Standard
—hand lever control with
extended stuffing box.



Consider the wide operating range of R-S Butterfly Valves. They are used for the reduction and regulation of pressure whether above or below atmosphere; to control liquid level; to relieve pressure and control back pressure; to maintain a constant differential pressure; to control rate of flow; to control combustion automatically as well as govern the output of pumps, fans, engines and turbines.

Coupled with these many uses and the inherent advantages of the R-S Butterfly Valve, are special metals for use where hard wear and severe stresses are encountered or where extreme temperatures and corrosive conditions exist. A further inducement to longer wear is the design of the valve itself. When the Butterfly vane approaches a closed position, the flow "fans out." There is no damaging "jet" effect to cause severe wear to the sidewall within a small area.

If your problem has to do with the control and shut-off of volume and pressure, and you are interested in simplified and less costly methods, write. Ask for R-S Catalog No. 14-B.

No. 586—A big 60-inch,
15-lb power-operated valve.

VALVE DIVISION
R-S PRODUCTS CORPORATION
132 Berkley Street • Philadelphia 44, Pa.

R-S Streamlined BUTTERFLY VALVES

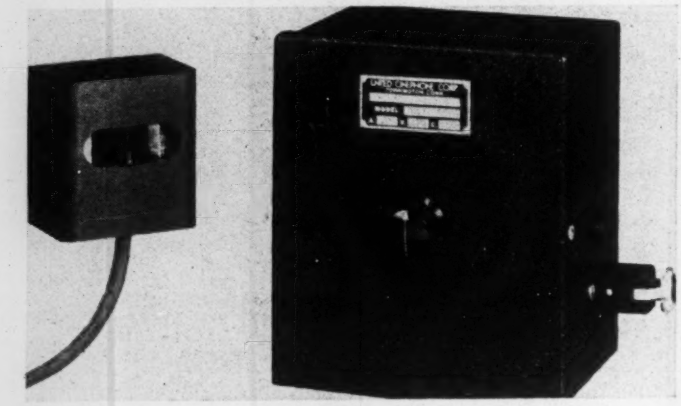
on and off levels and a low water danger point. The top and middle probes determine the high and low levels at which the boiler feedwater pump is turned on and off to maintain constant water level. When water falls below the middle probe, the electrical circuit controlling the pump is closed and water feeds into the boiler.

Types are available also for automatic pump control only, or for low level protection only.

These boiler feedwater controls are supplied as standard for boiler pressures to 300 psi and for operation from a supply of 115 or 230 volts, a-c, 60 cycles. The equipment governs solenoid valves, small horsepower pump motors, or pump motor magnetic starters. The probe housing is furnished in either cast or malleable iron, and the electronic control in a weatherproof pressed steel housing.—Combustion Control Corp., 77 Broadway, Cambridge 42, Mass.

Photoelectric Cutoff

No. 2522—An automatic photoelectric cutoff, which, according to the manufacturer, is a highly sensitive and compact unit, may be used to simplify a number of photoelectric control problems. It comprises a scanner, which is a small plastic housing containing a light source, a photo cell and amplifier tube, and the control, which is a small metal housing containing three stages of amplification and a sensitive relay.

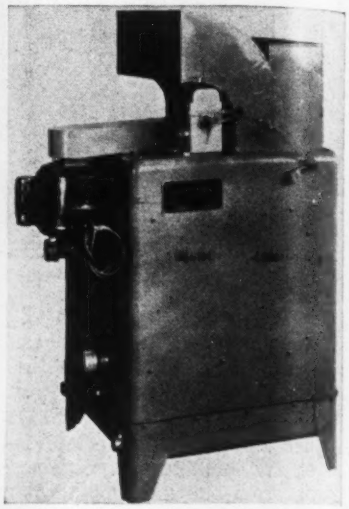


The scanner is so designed as to facilitate simple mounting methods. The position of the scanner is adjusted in accordance with the control desired.

Models are available with contact load capacities of 3, 10, and 17 amp.—United Cinephone Corp., Torrington, Conn.

Compressed Air and Gas Cooling Equipment

No. 2523—Improved equipment for the cooling of compressed air results in dryer air and prevents water damage to pneumatic equipment; for example, rapid wearing out of parts because of washing out of lubricants, freezing up of pneumatic tools halting production, damage to work by water in paint spray, rusting of metallic shot in blast cleaning equipment, etc.



The new "Aero" aftercooler for compressed air uses the evaporative cooling principle to obtain the lower temperatures and a new design gives greatly increased capacity in compact apparatus, says the manufacturer. Air, drawn by a fan through a water spray across coils con-

WECO-N. G. E. Series F600 GAS BURNERS

These burners are available for ratings from 50,000 to 10,000,000 B.t.u. output, for use in heating boilers, power boilers—in any metal firebox or sectional boiler.

Featuring flexibility to meet various firebox shapes and sizes at various gas pressures, and low draft loss. Full automatic controls that operate properly can be easily applied.

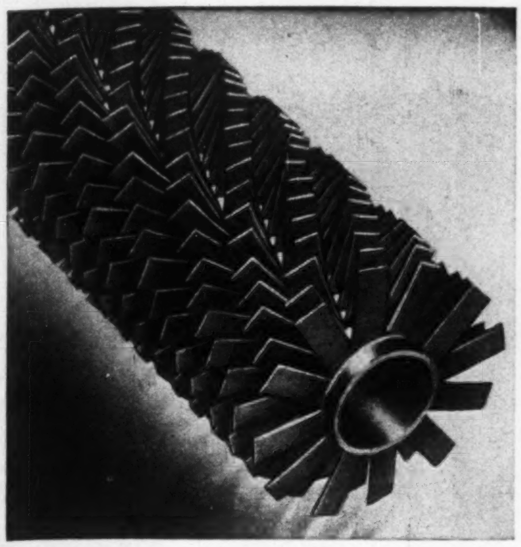
GUARANTEED VIBRATIONLESS

This burner operates on straight natural gas and mixed gas to 800 B.t.u. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

THE WEBSTER ENGINEERING CO.

TULSA —DIVISION OF— OKLAHOMA

Surface Combustion . . . . Toledo, Ohio



NOW—
Helically Wound Fins
WELDED *to* TUBE *or* PIPE

ALL STEEL

WELDED *for increased efficiency**

WELDED *for greater durability*

WELDED *for unvarying performance*

TILCO-FIN
the extended surface tubing with
"DUAL EFFICIENCY"

—High heat transfer

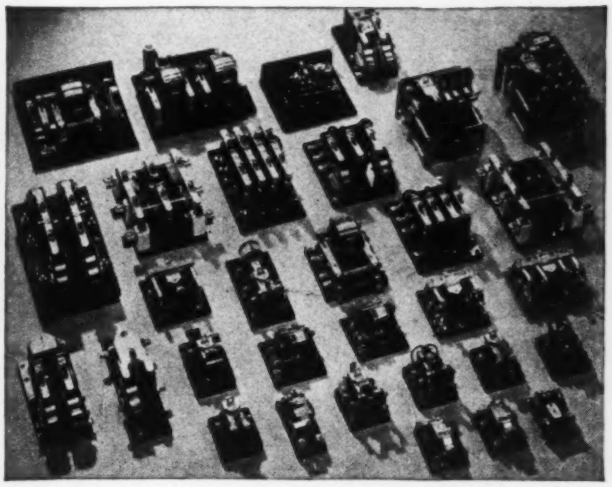
Welded extended surface tubing provides extremely high heat transference.

—Low resistance

Finned surface furnishes much less resistance to the passage of air than accepted standards.

*In a recent shell and tube heat exchanger application, Tilco — Fin's new Weld-On steel tube was found to have 94% of the effectiveness of the original all prime copper surface. The change to Weld-On tubes from bare copper tubes increased the output of the same shell 258%.

TILCO-FIN, INC., 68 SECOND AVE., BROOKLYN 15, N. Y.



JUST THE RELAY YOU WANT

When you can select the relay that exactly meets your requirements from a regular line, you have saved man power, time and money. WARD LEONARD RELAYS include types and sizes for every application. They all have crisp action, are dependable and durable yet consume but little current. Why have a "special" designed when there is an existing WARD LEONARD Relay that will serve your purpose?

WL Relay Bulletins

Bulletins are available describing light, intermediate and heavy-duty relays in various contact combinations, high voltage relays, metal and molded base midgets, aircraft power relays, transfer relays, sensitive relays, thermal and motor-driven time delay relays, latch-in relays, and various types of radio relays. Send for the data bulletins of interest to you.

ARMY E NAVY
ARMY E NAVY

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control* WL *devices since 1892.

WARD LEONARD ELECTRIC COMPANY
31 SOUTH STREET, MOUNT VERNON, N. Y.

taining the compressed air, is the cooling medium and temperatures within 10 F of the wet bulb air temperature can be maintained, it is stated. This "produces compressed air that contains only one-half to three-fourths the amount of water formerly experienced with the best practice." The equipment is also applied to gases generated for industrial use.—Niagara Blower Co., 6 E. 45th St., New York 17, N. Y.

Alternative for Rubber

No. 2524—A new elasto-plastic known as "Marvinol," which was recently announced, is not a synthetic rubber, according to the manufacturer, but "a completely new material which is better suited than rubber for many of the purposes for which rubber has previously been used." Another feature of the material is that it is 100 per cent reclaimable. It can be processed on standard rubber working machinery.

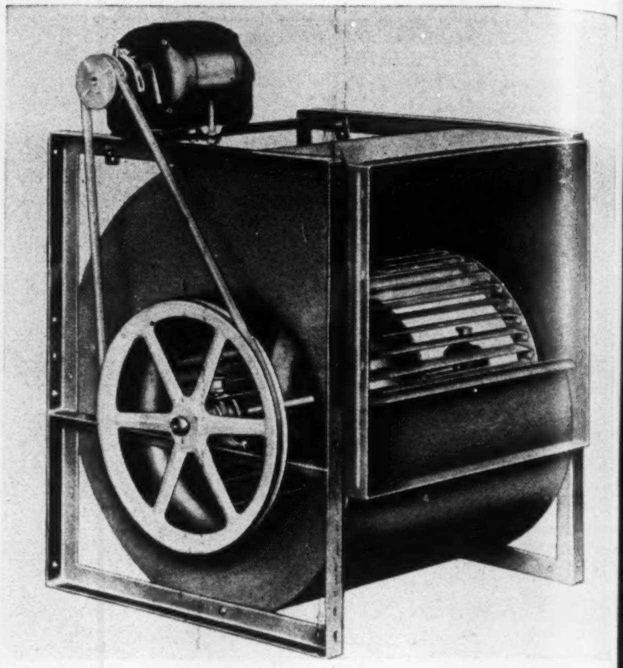
Development of a wide range of products made of this material, including flexible gas and air lines and many other items, is expected after the war.—Glenn L. Martin Co., Baltimore, Md.

Blowers Have Four Way Discharge

No. 2525 — Four way discharge is a feature of a new line of standard duty blowers. The design permits installation in the top horizontal, top vertical, bottom horizontal, or bottom vertical discharge positions, says the maker.

While the blowers are furnished with bearings assembled for top horizontal discharge, a simple change in the bearing position alters the discharge of the blower, even on the job.

These belt driven units can be furnished on proper priority order, from 9 to 24 in. wheel diameter, single inlet single width, and double inlet double width.—Utility Fan Corp., 4851 S. Alameda St., Los Angeles 11, Calif.



Photoelectric Flame Failure Safeguard

No. 2526** — "Fireye type F28C," a photoelectric system for providing instantaneous fuel cutoff in any pressure fed burner in the event of flame failure, was announced last month. Capable of monitoring flame of any intensity, the system is applicable to oil, gas, or pulverized coal burners and operates entirely from direct observation of the

NON-METALLIC
SAL-MO SUPPLY DUCT

for PUBLIC BUILDINGS — INDUSTRIAL BUILDINGS, HOMES & HOUSING PROJECTS

Sal-Mo Supply Duct is **SAFE**—Approved and Listed for Safety, Heating and Permanence, by ***UNDERWRITERS' LABORATORIES, INC.*** **COMPACT**—Exclusive patented folding feature saves space in cars, storage and in transfer to job; saves time in erection. **INSULATING**—Made of Asbestos. Built-in insulation assures years of fuel saving. **LIGHT**—Weighs less than 8 oz. per square foot. **STRONG**—Proved by Mullens Test, over 400 lbs. per square inch. **MOISTURE RESISTANT**—Fabricated entirely with insoluble adhesives, high humidity will not separate the various layers.

Manufactured in 26 standard sizes (areas from 26 square inches to 448 square inches in 4-foot lengths), allowing for all types of installations. It is also furnished in flat sheets containing 11 to 24 square feet which can be easily rolled or scored on the job.

FOR WARM AIR HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS.

A Typical Duct Installation in a Large Church Building.

Sal-Mo Asbestos Insulated Supply Duct Was Used Throughout.

SALL MOUNTAIN COMPANY
Asbestos
UTILITY SERVICE ECONOMY

SALL MOUNTAIN COMPANY
176 WEST ADAMS STREET • CHICAGO 3 • ILLINOIS

DISCOMFORT DEFEATS PEAK PRODUCTION

WARM UP *the* COLD SPOTS

WITH YOUNG UNIT HEATERS

TYPE "VS" FOR VERTICAL AIR FLOW
YOUNG

More consideration than ever will be given to the comfort and health of war workers this winter . . . not only to prevent illness that results in absenteeism, but to invite employment, build loyalty and morale, and increase production efficiency. If heating facilities were inadequate last year, if cold spots were detected or if departments have been rearranged, Young Streamaire Unit Heaters can be used to advantage. Their saving of floor space, ease of installation, low first cost, efficient operation and low maintenance cost make Young Unit Heaters desirable for existing or new buildings and additions. Write us direct or consult with the Young representative in your locality, for the solution to heating and air conditioning problems.

YOUNG RADIATOR COMPANY
Dept. 113-L Racine, Wis., U.S.A.

TYPE "SHS"
FOR HORIZONTAL
AIR DELIVERY

BUY BONDS
PRODUCE MORE
SALVAGE SCRAP
WIN THE WAR

YOUNG

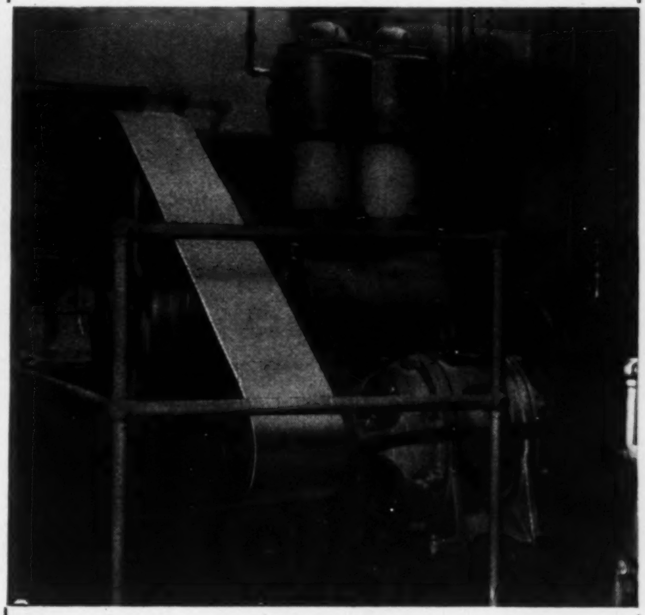
HEAT TRANSFER PRODUCTS

Oil Coolers - Gas, Gasoline, Diesel Engine Cooling Radiators - Intercoolers - Heat Exchangers - Engine Jacket Water Coolers - Unit Heaters - Convectors - Condensers - Evaporators - Air Conditioning Units - Heating Coils - Cooling Coils - and a complete line of Heat Transfer Equipment for aircraft.

CHOOSE

The Dependable Drive

that keeps power flowing steadily



Get the Tannate Rockwood Drive

Even when the load fluctuates, the weight of the motor on the pivoted Rockwood base automatically adjusts the belt tension . . . so efficiency is always high. The Tannate Leather Belt helps that, too, for it grips the pulleys tightly, runs smoothly and pulls steadily. It requires little attention aside from an occasional application of Rhoads Tannate Belt Preserver. On many air conditioning equipment installations, Tannate-Rockwood units are considered the drives you can install and then forget. Dependable—economical.

RHOADS
Tannate-Rockwood
PRODUCTION DRIVE

—Established 1702—

J. E. RHOADS & SONS

35 North 6th Street **Philadelphia 6, Penna.**
NEW YORK • CHICAGO • ATLANTA • CLEVELAND

SOMETIME (SOON?)

PETRO
REG. U. S. PAT. OFF.
OIL BURNING SYSTEMS

will be available once more for normal business.

Their "Oil Miser" economy will contribute much to post-war efficient operation at low cost.

Automatic, semi-automatic or manual operation using No. 5 (or lighter) oil —or No. 6 (Bunker "C") oils, preheated. Capacities to 145 gallons per hour. 487 boiler H. P.—68,000 sq. ft. steam.

Even war-time research has not discovered any method of heavy oil combustion that equals or improves Petro's Thermal Viscosity principle of automatic firing at constant efficiency.

As a principle of design and operation, rather than a mechanical part, it can't wear out or break down. It cuts "service" as well as operating supervision.

Petro Engineers are working on post-war plans with a lot of Contractors. Can they help you?

OIL IS AMMUNITION
USE IT WISELY

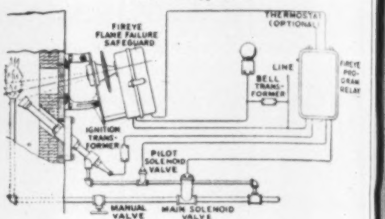
Full data on Petro Industrial Burners are in our Catalog—see Sweet's or Domestic Engineering Catalog Files—or we will gladly send copies on request.

PETROLEUM HEAT AND POWER COMPANY

Makers of Good Oil Burning Equipment Since 1903

STAMFORD CONNECTICUT

FIREYE Type F28C



Typical FIREYE

Installation For Automatically Ignited Oil Burner

flame itself rather than wholly or partly from such secondary flame characteristics as temperature or electrical conductivity, says the manufacturer. Because the device is actuated not by the effect of flame failure, but by the actual presence or absence of flame, it operates immediately and therefore eliminates the explosion hazard present when even a few seconds elapse before fuel cutoff.

This unit is used with manually ignited burners to cut off fuel and sound an alarm; or, when the burner is automatically fired, with a relay to program fuel pump and valve operation, intermittent ignition system, purging period, and recycling.

Designed to operate at relatively high ambient temperatures, it is mounted directly on the furnace wall and watches the flame through a window in the wall of the fire chamber. Once the lens of the optical system has been aligned, the field of vision of the electric eye is limited to the flame itself and extraneous light is rejected. Light from the flame strikes the sensitive plate of the photocell and starts a flow of electrons, producing a minute electrical current. After passing through a vacuum tube, this current is amplified sufficiently to operate a relay which directly controls a solenoid valve governing fuel feed, or a relay which programs the entire cycle of burner operation. While the electric eye sees flame, fuel is fed to the burner. Should flame fail, or any condition impairing safe operation develop within the electronic control, the fuel supply is cut off until proper combustion conditions are restored.—Combustion Control Corp., 77 Broadway, Cambridge 42, Mass.

Gas Pipe Line Economics

The July, 1943, Transactions of the American Society of Mechanical Engineers includes a paper on An Analysis of Gas Pipe Line Economics, by H. C. Lehn, consulting engineer, Worthington Pump & Machinery Corp., which was presented at the annual meeting of the ASME last December.

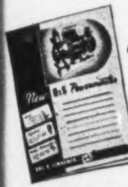
In designing gas pipe lines the aim is to develop characteristics which will result in the lowest operating cost. The customary approach to this problem is to utilize formulas for line capacity and compressor horsepower as a basis for line design and from it the expected cost of operation. By trial the effect of varying the line and compressor characteristics can be observed. This paper shows that sufficiently accurate equations, involving all essential factors, can be developed and that these equations can be readily solved to determine the specifications of a line of theoretical minimum cost. Adjustments to commercial requirements, principally the factors of pipe diameter and station spacing, are possible with only slight divergence from theoretical results.

Copies of these Transactions may be obtained for $1.50 from the ASME, 29 W. 39th St., New York, N. Y.

Gets "Steam Up" Faster!

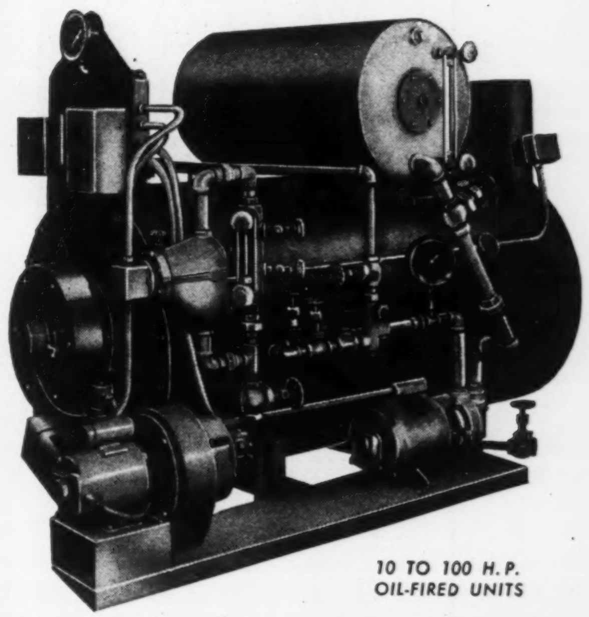
NEW O&S *Powermaster* UNIT'S "BALANCED DESIGN" GIVES YOU MOST EFFICIENT STEAM PRODUCTION . . .

Backed by 58 years of boiler engineering and manufacture, this "packaged" steam generator assures the high efficiency, economy and durability you want. Compact. Lightweight. Easy to install. Easy to clean. And fully automatic . . . cuts maintenance attention to a minimum.



Get Powermaster Bulletin No. 1213 . . .

It gives you complete information on this new O & S Steam Generating Unit. Your copy will be promptly mailed, without obligation. Write now to ORR & SEMBOWER, INC., 942 MORGANTOWN ROAD, READING, PA.



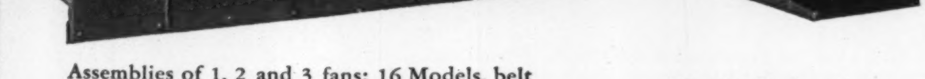
10 TO 100 H.P.
OIL-FIRED UNITS

ORR & SEMBOWER INC. O&S *Builders of Better Boilers Since 1885*
READING • PENNSYLVANIA

NIAGARA *Industrial* MOTOR BLOWERS

for VENTILATING, DRYING, EXHAUSTING FUMES *and* LIGHT DUST, HEATING, COOLING, RE-CIRCULATING

3-Fan Unit, Encased, Belt-Driven



Assemblies of 1, 2 and 3 fans; 16 Models, belt driven or direct connected with and without casings. Two series of fans for highest air capacity—up to 4" S. P.

Especially designed to meet the requirements of duct systems in blast heating or cooling or in industrial exhaust systems.

Write for Bulletin 89

NIAGARA BLOWER CO.
Dept. 113HP
6 E. 45th Street New York City

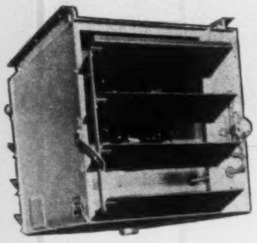
461 Statler Office Bldg., Boston
673 Ontario Street, Buffalo, N. Y.
37 W. Van Buren St., Chicago
648 Hanna Bldg., Cleveland, Ohio
2832 E. Grand Blvd., Detroit
Room 1222, Commercial Trust Bldg., Philadelphia
Fourth & Cherry Bldg., Seattle

District Engineers in Principal Cities

NIAGARA *INDUSTRIAL COOLING • HEATING • DRYING HUMIDIFYING • AIR ENGINEERING EQUIPMENT*

KRAMER
LOW TEMPERATURE
Unit Coolers

FREEZING OVEN
Electrical Defrost

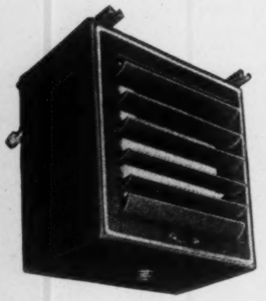


for LOW TEMPERATURES (below 32°)

THE FREEZING OVEN is a low temperature unit cooler with a self-contained electrical defrost mechanism. The complete unit is housed in an insulated shell with insulated front and rear adjustable louvers.

SPECIFICATIONS: All copper KRAMER coil, ⅝" tube, ½" fin spacing, fin sweated to tube. An electrical heater of suitable wattage, suction line hand valve mounted on shell shunted by a relief valve. Insulated steel housing, insulated adjustable front and rear louvers, specially designed silent fan driven by totally enclosed fan duty motor of proper capacity designed for continuous operation.

FREEZING SHOWER
Water Defrost



MATE TO THE FREEZING OVEN

THE KRAMER FREEZING SHOWER offers a low temperature unit using a water shower of ordinary tap water to defrost. It can be completely defrosted in a few minutes without effecting the temperature of the box, simple to install and operate.

Send for descriptive Folders on the KRAMER FREEZING OVEN and the KRAMER FREEZING SHOWER.

KRAMER TRENTON CO.
Trenton, New Jersey

RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on page 135. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Air Conditioning and Industrial Refrigeration

No. 4561—20 p. booklet (3AC-0201) explaining how controlled temperature, humidity, and air cleanliness mean uniform quality, precision, fewer rejections, and faster production. The hermetically sealed compressor is illustrated and described and its development from 1932 to the present is traced. The manufacturer's complete line of air conditioning and refrigeration equipment, including models from 1 to 100 hp, is illustrated.—Westinghouse Electric & Mfg. Co., East Springfield, Mass.

Balancing Machines

No. 4562—32 p. booklet (1092) covering the manufacturer's line of balancing machines, turret lathes, and automatic lathes, showing in concise manner various types and sizes through large photographs accompanied by principal specifications and brief running descriptions.—Gisholt Machine Co., 11 S. Baldwin St., Madison, Wis.

Boiler Water Levels

No. 4563—8 p. bulletin (WG-1820) on application and operating advantages of the "Yarway" remote water level indicator, which "brings boiler water levels down to eye level reading on a brilliantly illuminated, two-color scale."—Yarnall-Waring Co., Chestnut Hill, Philadelphia 18, Pa.

Books

No. 4564—249 p. catalog for 1943-44 of technical and engineering books with a complete index of authors and titles, and a complete index of subjects.—John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y.

Compressors

No. 4565—16 p. bulletin (651-A) on large four cylinder refrigeration compressors, discussing general design and describing features of construction in detail. Principal dimensions are shown.—Frick Co., Waynesboro, Pa.

Copper and Copper Base Alloys

No. 4566—2 p. schedule on standard commercial wrought coppers and copper base alloys giving the name of each, its composition, and the forms generally available. The schedule is the result of a study made by a committee "designed to set forth the alloys which over a period of years have been the ones most commonly ordered in large quantities."—Copper & Brass Research Association, 420 Lexington Ave., New York 17, N. Y.

Evaporative Condensers

No. 4567—16 p. bulletin (3B) on "Wat-R-Miser" evaporative condensers, equipped with air filters, briefly discussing

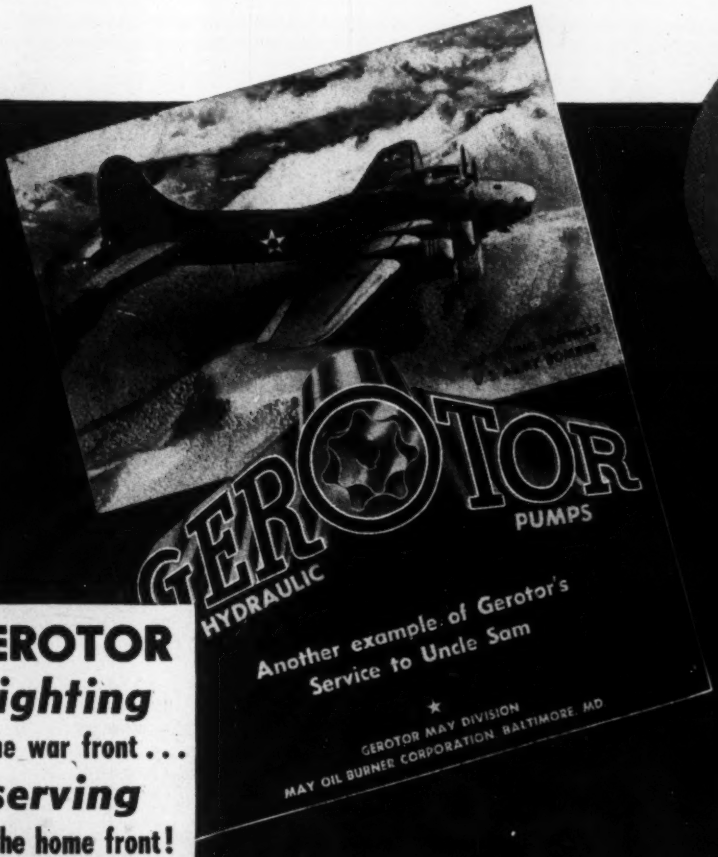
NOT JUST ONE BUT ALL.. Every Liberty ship that sails the seas is K & M equipped. We at K & M get real satisfaction from knowing that our 65 years of experience enables us to produce *better* pressure and fluid control specialties . . . and to produce them *faster*. Inquiries invited. *Write for Catalog No. 66.*

SPECIAL REPAIR DEPARTMENT

If you can't get *new* K & M valves and controls, send us your old equipment for repair. By George, we'll do it *fast* . . . 10 days to 2 weeks, maximum!

KM KIELEY MUELLER ESTABLISHED 1879

KIELEY & MUELLER
PRESSURE & FLUID CONTROL SPECIALTIES
NORTH BERGEN, NEW JERSEY


GEROTOR
HYDRAULIC
PUMPS
Another example of Gerotor's Service to Uncle Sam
★
GEROTOR MAY DIVISION
MAY OIL BURNER CORPORATION BALTIMORE, MD.

GEROTOR
fighting
on the war front . . .
serving
on the home front!

QUIET MAY OIL BURNERS

Backing the attack in the air, on land and on the sea is our world famous GEROTOR pump. After Victory . . . GEROTOR will *back* your drive for post-war business — and its fautless performance will make it *easy* for you to sell more and more Quiet May Oil Burners. May Oil Burner Corporation, Baltimore, Maryland.

advantages and describing the pitched tube condensing coils, and positive drainage with them, other construction advantages, and giving tables of dimensions, selection tables, and charts of pressure loss in discharge and liquid lines.—Drayer & Hanson, Inc., 738 E. Pico Blvd., Los Angeles, Calif.

Expansion Joints

No. 4568—14 p. bulletin (35-15C) on the "Adsco" piston ring type slip expansion joint which "can be completely unpacked and repacked under full operating pressure." It is available in sizes from 1½ to 20 in. for steam pressures to 400 psi.—American District Steam Co., 25 Bryant St., North Tonawanda, N. Y.

Fans and Blowers

No. 4569—40 p. catalog (14-B) on "Hartzell Charavay" axial flow fans and blowers, including information on accessory products and miscellaneous data on duct resistance, how to select the fan or blower for the job, propeller design and development, etc. Complete dimensional information is included and there are performance tables and other data.—Hartzell Propeller Fan Co., P. O. Box 909, Roosevelt Ave., Piqua, Ohio.

Gages

No. 4570—32 p. catalog (38-G) on industrial gages, describing and illustrating the various types and giving detailed information on dimensions, etc.—Ashton Valve Co., 161 First St., Cambridge, Mass.

Gaskets

No. 4571—Chart showing cross sections of 36 popular gasket types, their purposes, and the characteristics which fit them for the specific services intended. This chart is featured in the second issue of a publication entitled The Gasket.—Goetze Gasket and Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J.

Industrial Chilling Equipment

No. 4572—24 p. technical data and operating manual for industrial chilling equipment applied to shrinking, testing, and treating of metals to 120 deg below zero. The book covers a few of the many applications throughout industry and describes a number of them, showing the savings and increased production resulting from the use of the chilling equipment.—Deepfreeze Div., Motor Products Corp., 2301 Davis St., North Chicago, Ill.

Non-metallic Duct Fabrication

No. 4573—8 p. booklet describing fabricating methods for lock joining non-metallic boards by means of a self-fastening strip, with information on cutting the strip, the various steps in making ducts from flexible boards, fabricating rigid sheet board, cutting asbestos cement board, and placing steel strapping around ducts.—Sheetlock Co., 4521 N. Clark St., Chicago 40, Ill.

Pipe and Tube Bending

No. 4574—80 p. handbook on pipe and tube bending methods and devices for bending pipe and tubes of copper and its alloys. It contains 80 pp. of text with 113 figures and illustrations including 35 pp. of unit weights of tubes of different alloys with varying diameters, wall thicknesses and shape, as well as pertinent information on chemical and physical properties. The text covers subjects such as hot and cold bending, minimum radii, temper, the use of mandrels of various types, and many other essential factors. Bending with the use of filler materials—such as

BUY WAR BONDS

AIR CONDITIONING UNITS ☆

KENNARD FINNED COILS

SPECIAL HEAT EXCHANGE SURFACE APPLICATIONS WITH KENNARD COILS

☆ Food Dehydration and Preservation. ☆ Crane Cab Air Conditioning. ☆ Gauge Laboratory. ☆ Shipboard Heating. ☆ Evaporative Condensers and Coolers. ☆ Low-Temperature Test Rooms. ☆ Air Conditioning for Precision Production.

HEATING COILS for use with steam or hot water.

COOLING COILS for use with direct expansion refrigerants, cold water or brine.

We are equipped to fabricate most types of STEEL COILS. Steel coils available either hot dipped galvanized, or paint dipped. COPPER COILS on W.P.B. approval.

One of several hundred special copper and aluminum water coils used in evaporative coolers in portable oxygen generators.

SAM KENNARD INC.

4821 Easton Ave.
ST. LOUIS 13, MO.

☆ REFRIGERATION BLOWER UNITS

Mortite UTILITY TAPE

HUNDREDS OF USES

★

INSULATES • WEATHERSTRIPS
PLUGS UP CRACKS • MAKES PACKING
OR GASKETS • CAULKS CASEMENTS
GLAZES WINDOWS

This new pliable plastic does not crack, chip, dry out or shrink. Easy-to-handle, unrolls like ribbon and is ready for use, inside or outside. Can be painted.

SIMPLE TO APPLY

Mortite adheres to any clean, dry surface. No tacking or tools needed, just press into place and it stays put.

About 80 ft. to a roll. Order through your supply house or $1.25 postpaid. ($1.40 west of Rockies.)

Circular Free

J. W. MORTELL CO.
512 BURCH ST.
KANKAKEE, ILLINOIS

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

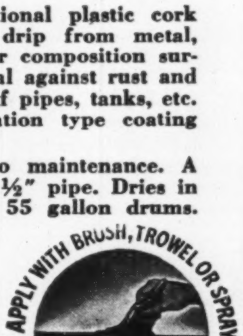
NoDrip A SURE CURE

• This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition surfaces. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance. A gallon covers about 30 feet of ½" pipe. Dries in 24 hours. Comes in 1, 5 and 55 gallon drums.

Immediate Shipment. Order from your Supply House.

FREE NoDrip Circular about Condensation Drip and its Prevention.



J. W. MORTELL CO.
Technical Coatings Since 1895
512 BURCH ST. KANKAKEE, ILL.

HERMAN NELSON hiJet HEATERS installed at Douglas Aircraft Chicago Plant

Over 400 Herman Nelson Vertical Shaft Propeller-Fan Type hiJet Heaters are supplying comfortable temperatures in working areas at the mammoth new Chicago Plant of the Douglas Aircraft Company. Because Herman Nelson hiJet Heaters provide heat where it is wanted and when it is wanted, without waste of fuel or space, they are vitally important to the world's largest exclusive cargo-plane manufacturing plant.

In addition to many models, sizes and arrangements of hiJet Heaters, The Herman Nelson Corporation manufactures Autovent Fans and Blowers for industrial, commercial and public buildings. Thus practically any heating or ventilating problem can be most satisfactorily and economically solved with Herman Nelson equipment.

The Chicago Douglas Plant is scheduled to produce great numbers of these C-54 "Skymasters."

THE HERMAN NELSON CORPORATION

MOLINE, ILLINOIS

AUTOVENT FAN AND BLOWER DIVISION · CHICAGO, ILLINOIS
Manufacturers of Quality Heating, Ventilating and Air-Conditioning Products

sand, rosin, salt, and low melting temperature alloys—is described and illustrated. Step by step procedures for both smooth and wrinkle bending of large diameter pipe show methods and equipment in considerable detail.—Copper & Brass Research Association, 420 Lexington Ave., New York 17, N. Y.

Steel Stock List

No. 4575—244 p. stock list and reference book listing the stocks of steel, steel products, tools, equipment, and machinery that the publisher handles, with a complete and easy to use index.—United States Steel Supply Co., 1319 W. Wabansia, Chicago 90, Ill.

Stokers

No. 4576—Two check charts for single retort and multiple retort stokers, designed to assist in making regular and thorough inspection of stokers. They are printed on heavy cardboard approximately 16 x 21 in.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Synthetic Rubber

No. 4577—44 p. booklet, entitled Towers of Triumph, giving a chronological story of the drama of synthetic rubber, answering common questions about it, and showing many interesting illustrations.—Dayton Rubber Mfg. Co., 2345 W. Riverview Ave., Dayton, Ohio.

Valves

No. 4578—32 p. catalog (41-V) on industrial, pop safety, and relief valves, describing and illustrating the construction features of each model and giving dimensional and capacity data and other information.—Ashton Valve Co., 161 First St., Cambridge, Mass.

Valves

No. 4579—8 p. bulletin reprinting a series of advertisements on stop valves, check valves, blow down valves, non-return valves, and other types.—Edward Valve & Mfg. Co., Inc., 1200 W. 145th St., East Chicago, Ind.

Variable Speed Pulleys

No. 4580—42 p. engineering manual on variable speed pulleys for solving speed change problems in a variety of applications. Features, construction, and advantages are described in some detail, and dimensions and other engineering data are included.—Speedmaster Co., 1203 Thacker St., Des Plaines, Ill.

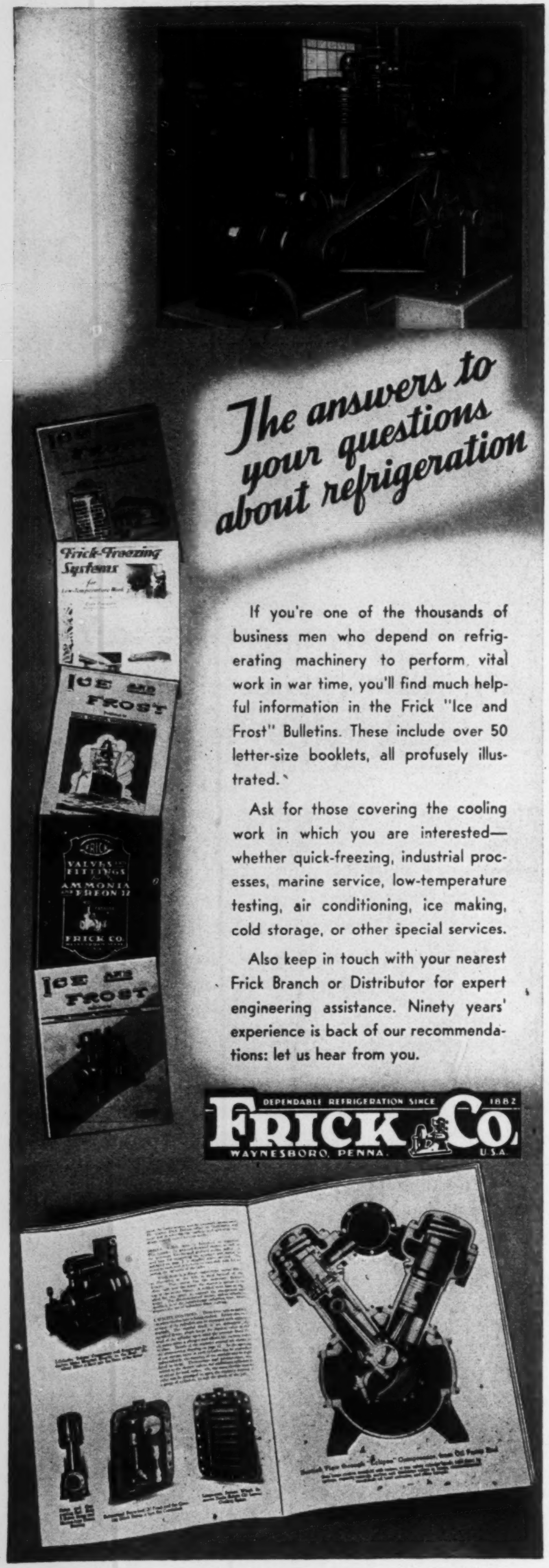
Welding and Cutting Fires

No. 4581—16 p. booklet on preventing welding and cutting fires, containing brief discussions of the chief causes of fires and practical measures for preventing them.—International Acetylene Association, 30 E. 42nd St., New York 17, N. Y.

Welding Positioning Equipment

No. 4582—4 p. bulletin (201) describing in concise form the manufacturer's line of welding positioning equipment, giving specifications, important features, load rating tables, and dimensions.—Ransome Machinery Co., Dunellen, N. J.

★ *All-out conservation is a vital contribution to the war effort. Do all you can to save coal, oil, gas, electricity, water, transportation, and communication facilities.* ★



The answers to your questions about refrigeration

If you're one of the thousands of business men who depend on refrigerating machinery to perform vital work in war time, you'll find much helpful information in the Frick "Ice and Frost" Bulletins. These include over 50 letter-size booklets, all profusely illustrated.

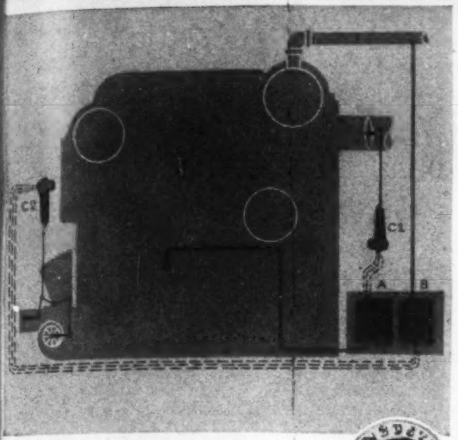
Ask for those covering the cooling work in which you are interested—whether quick-freezing, industrial processes, marine service, low-temperature testing, air conditioning, ice making, cold storage, or other special services.

Also keep in touch with your nearest Frick Branch or Distributor for expert engineering assistance. Ninety years' experience is back of our recommendations: let us hear from you.

DEPENDABLE REFRIGERATION SINCE 1882
FRICK Co.
WAYNESBORO, PENNA. U.S.A.

Dependable Automatic Boiler Control

AT SURPRISINGLY LOW COST . . . BY HOTSTREAM



Typical installation of Hotstream controls on stoker-fired industrial steam plant.
(A) Dampertrol, (B) Steptrol,
(Cl & 2) Electric Pistons.

Hotstream engineers designed this line of Combustion Equipment to provide low-priced, dependable boiler control at a cost low enough to be within the reach of every plant, large or small. Results are comparable to those obtained from elaborate, expensive systems—at but a fraction of the cost. Listed as essential fuel-saving devices by W.P.B., they are available now *without priority* . . . Typical installation at left shows how Hotstream Dampertrol (A) regulates uptake damper through Fast Stroke Electric Piston (C1) from changes in overfire draft, while Hotstream Steptrol (B) controls fuel and air supply through Electric Piston (C2) from changes in steam pressure.

HOTSTREAM ALSO OFFERS:

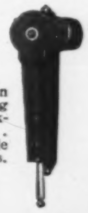
THERMOGAGE . . Electric flue-gas-temperature indicator.
DRAFT GAGE . . Overfire, last-pass, or uptake—draft indicator.
AIR-PRESSURE GAGE . . Indicates undergrate pressure or pressure in air-conditioning ducts and filtering systems.
DRAFT-O-STAT . . Barometric draft control for domestic, commercial and industrial installations.

AGENTS: Several attractive territories still open. Write for complete literature.

DAMPERTROL

Hotstream Dampertrol . . . control for Electric Piston operating from draft or air pressure.

Hotstream Steptrol, control for Electric Piston operating from steam pressure.



Hotstream Electric Piston for regulating dampers, stokers . . valves . . etc. . . . Made in 3 speeds.

Combustion Equipment Division

THE HOTSTREAM HEATER COMPANY

8007 Grand Avenue • Cleveland 4, Ohio

INDUCTION HEATING FOR WELDING

FOR UNIFORMITY — *SPEED* — DEPENDABILITY

- ★ **Prevents cracking when welding**
- ★ **Relieves strains after welding**
- ★ **Makes faster, safer welds**
- ★ **Preheat That Weld . . . and be SURE!**

Preheating by the Smith-Dolan Induction Method generates heat uniformly throughout the welding area. This heat is easy to apply exactly where it is wanted. It is controllable within close limits.

This clean-cut, economical method of heating is unsurpassed. It can be applied in regular production, or to existing installations, which are impossible to preheat by any other method. This unique System is offered exclusively by us, together with engineering advice to fit your individual problem.

Electric Arc, Inc.

"ALTERNARC" TRANSFORMER WELDERS
"DUALARC" GENERATOR SETS
"NEWARC" ELECTRODES AND SUPPLIES

**152 TO 162 AND 218 JELLIFF AVENUE,
NEWARK 8, NEW JERSEY**

• NEW BOOKS & REPORTS •

Drying and Dehydration of Foods

It would be expected that the national and international importance of food drying should give rise to at least one book devoted to a description of present methods of drying foods. Such a book has been prepared by Harry W. von Loesecke, senior chemist in the bureau of agricultural chemistry and engineering, U. S. Department of Agriculture.

In the foreword to Mr. von Loesecke's book, which is entitled Drying and Dehydration of Foods, R. S. Hollingshead has indicated the immediate importance and magnitude of food drying in the United States with the following statistics on the anticipated production of dried foods for 1943:

Type of Food	Millions of Pounds
Vegetables	355
Soups	207
Milk	517
Eggs	460
Meat	110
Fruit	50

In the conclusion to his foreword, Dr. Hollingshead points out that the information in the book is not to serve as an operator's manual, but is essentially a "general outline of procedure and practices in commercial use."

The book consists of 10 chapters, on types of dehydrators; sun drying and dehydration of fruit; dehydration of vegetables; dehydration of eggs, milk, and butter; dehydration of meat, fish, and beef blood; plant sanitation; costs of dehydration; nutritive value of dried and dehydrated foods; packaging and storage; and methods of analysis, and reconstitution of dehydrated foods. A glossary of terms and a list of some 200 patents are appended in the last pages.

The contents of these chapters are intended to fulfill the stated purpose of the book, "to place before those interested in food dehydration a compilation of the latest practical information dealing with this subject." The first chapter on the types of dryers could have been made more complete in its description of the different drying methods, and the types of dryers and their operating characteristics. In a manner typical of the food drying industry, the importance and virtues of tunnel dryers are stressed, while only brief mention is given to the operating characteristics of the vacuum, rotary, spray, drum, compartment, and conveyor dryers, although spray drying receives added attention in the chapter on egg and milk drying.

A method of calculating the heat and air quantities for a tunnel dryer on the basis of elementary heat and material balances is presented. In this connection, the cumbersome humidity charts given in the Department of Agriculture circular 619 (1942) have been included. It is unfortunate that the more generally familiar psychrometric chart in which the humidity in absolute units is plotted vs. the air temperature was not used instead. In a footnote on p. 29, the author is obviously referring to the heat consumption of a dryer and not to the latent heat of vaporization referred to in the text. Further, the accepted value of the specific heat of water vapor at the temperatures involved in food drying is 0.45 and not 0.475 as used in the example. The calculation of the required air volume contains an arithmetical error so that the linear velocity over the trays should be 1040 instead of 643 fpm as given.

Chapters 2 and 3 give excellent summaries of the operations involved in drying some 16 different fruits and 26 different vegetables. In general, the method of description involves a discussion of the preparatory operations characteristic of each food, such as selection, grading, trimming, blanching, sulfuring, etc., followed by the usual methods of drying, the permissible temperatures to use, the proper final moisture content, and the yield expressed as per cent of raw initial product. In most cases for fruits, the chem-

PUMPS

SINCE 1920

THE SYMBOL OF SERVICE

For almost a quarter of a century, the Walter H. Eagan Company Trade Mark has been a symbol of service. Last year, engineers acknowledged this service by installing over 1000 units in 43 states.

CONDENSATE RETURN UNITS

Write for General Catalog No. 2
Consult us on your requirements

ARMY E NAVY

WALTER H. EAGAN CO.
2336-38 FAIRMOUNT AVENUE, PHILADELPHIA, PA.

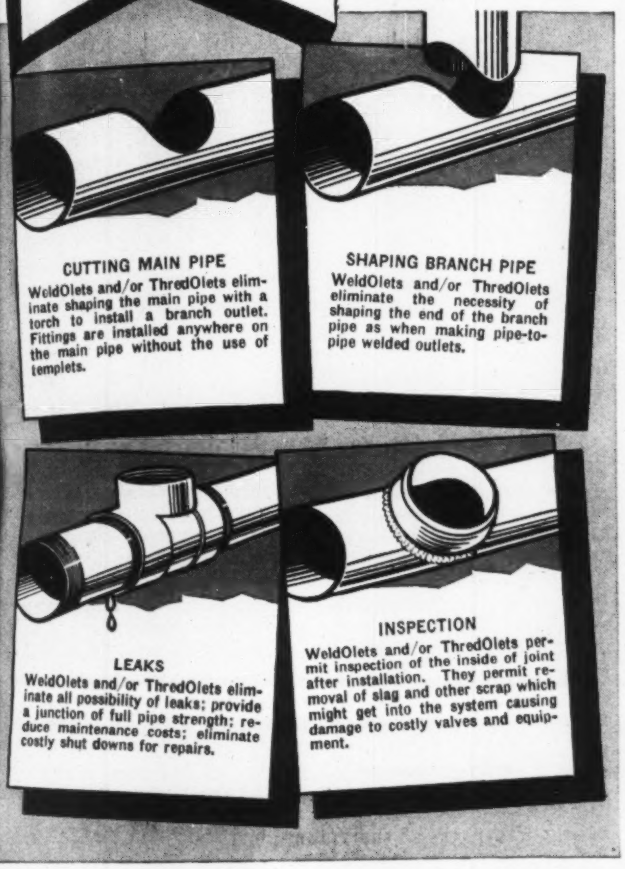
Make Good Piping Better with WELDOLETS · THREDOLETS

3 Types Meet Every Need

WeldOlets for butt welded branch connections.

ThredOlets for screwed branch connections.

Socket-End WeldOlets for socket-type welded branch connections.



CUTTING MAIN PIPE
WeldOlets and/or ThredOlets eliminate shaping the main pipe with a torch to install a branch outlet. Fittings are installed anywhere on the main pipe without the use of templets.

SHAPING BRANCH PIPE
WeldOlets and/or ThredOlets eliminate the necessity of shaping the end of the branch pipe as when making pipe-to-pipe welded outlets.

LEAKS
WeldOlets and/or ThredOlets eliminate all possibility of leaks; provide a junction of full pipe strength; reduce maintenance costs; eliminate costly shut downs for repairs.

INSPECTION
WeldOlets and/or ThredOlets permit inspection of the inside of joint after installation. They permit removal of slag and other scrap which might get into the system causing damage to costly valves and equipment.

WeldOlets, ThredOlets and Socket-End WeldOlets are suitable for all commonly used pressures and temperatures in every type of piping system. They are installed either before or after erection of the main line—and always with ease and economy. They are equally well adapted to prefabricated or "on-the-job" assemblies. Because of their patented, funnel-shaped intake aperture they improve flow conditions. Carried in stock for all standard pipe sizes up to 12" in size-to-size or reducing sizes—and can be furnished on special order in sizes up to 24". Stock fittings are drop forged steel, but to meet special conditions will be supplied in Monel, Everdur, Toncan Iron, wrought iron, etc.

Bulletin WT31 gives detailed information about all the advantages of WeldOlets, ThredOlets and Socket-End WeldOlets. Write for a copy today.

Forged Fittings Division
BONNEY FORGE & TOOL WORKS
ALLENTOWN, PA.

Star Awarded
July 10, 1943

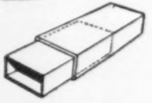
WELDOLETS·
TRADE MARKS REG. U. S. PAT. OFF.
THREDOLETS
Welded Outlets for Every Piping System

Careyduct
AIR CONVEYING SYSTEMS

AN INFANT *yesterday*... A GIANT *today!*

Before Pearl Harbor, Careyduct had won the widespread approval of the air conditioning industry because of its many superior advantages over insulated metal duct. Since then, the urgent need for conservation of metals and labor has added tremendously to the demand for this prefabricated duct.

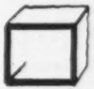
Careyduct is available in the following five different types:



INSULATED AND ACOUSTICAL TYPE

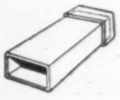
Made of Asbestos — combines both duct and insulation. Simple slip-joint construction and standardized parts provide easy and rapid fitting on job; "hushes" fan noises—reduces "speaking tube" effects

KEY-LOCK TYPE



For high temperature applications. Impervious to water, and effective for temperatures up to 500°F. This duct is supplementary to the Insulation and Acoustical Type. It is made from Carey Firefoil panel and is delivered knocked-down, with asbestos key for locking.

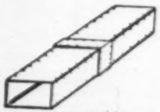
SINGLE-WALL TYPE



For use in heating and ventilating systems. It is an all asbestos product and is the same as inner core of the Insulated and Acoustical Type.

HINGED-CORNER TYPE

Fabricated of 1/8" asbestos board and is for use in residential heating jobs. It is delivered in cartons ready for assembly.



ASBESTOS-CEMENT TYPE

Made of different thicknesses of asbestos-cement wall board, in sizer from 23 1/2" up. It is supplied with special asbestos corners and is shipped knocked-down, complete with duct turns, sheet metal screws, connector pieces and Careyduct adhesive.

Write Dept. 25 for Careyduct Manual

THE PHILIP CAREY MFG. COMPANY
Dependable Products Since 1873 ***Lockland, Cincinnati, Ohio***

GET THAT AIR OUT OF THERE

With an
AUTO-VENT
AIR ELIMINATOR

Circulation Troubles?

Why continually fight air pockets or traps in hot or cold circulating lines? You can "get that air out of there" *and keep it out* simply by installing the No. 7 Maid-O'-Mist Automatic Air Vent. This reliable air vent has a self-closing float-controlled valve and is designed especially for circulating pipe lines, concealed radiators, unit heaters, cooling manifolds, tanks, diesel engines, or any other application where air pockets or traps retard the free circulation of liquids.

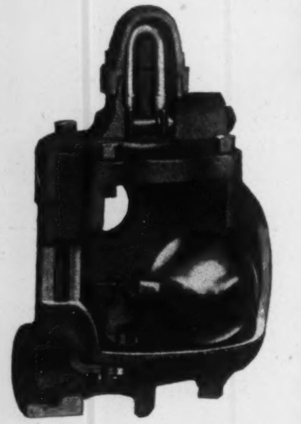
Now available in bright brass finish.

APPROVED FOR NAVY, MARITIME COMMISSION AND ARMY USE.

MAID-O'-MIST INC.
AUTOMATIC HUMIDIFIERS FOR ALL TYPES OF HEATING SYSTEMS
11 NORTH ABERDEEN STREET
CHICAGO 7, ILLINOIS

HAINES

FLOAT and THERMOSTATIC TRAPS



These Traps are designed to take care of any low pressure job up to 15 lbs. They will not become air bound as they employ the Bourdon Tube on the by-pass. Our underslung valve principle makes it safe at all times. No danger building up a pressure with this type of valve.

Furnished in sizes ¾", 1" and 1¼".

HAINES has proven its

Merit Simplicity Durability

WILLIAM S. HAINES & CO.
460 N. TWELFTH ST.
PHILADELPHIA

ical composition of the dried fruit is given. In some instances, current government specifications for certain dried foods are listed.

The chapter on the drying of eggs and milk shows the importance of spray and drum drying when liquids are involved, although few engineering data on the drying operations are given. Much of the chapter is devoted to methods of grading eggs prior to drying and to the various other prior and subsequent operations. The extent to which milk drying has been studied is reflected in the list of 22 patented processes which involve, for the most part, spray and drum drying.

About 18 pp. are devoted to meat, fish, and blood drying, and the present general methods are described. As in other cases, much of the material concerns the important preparatory processes.

In the 23 pp. on plant sanitation, the methods of disposing the waste from vegetables and dairies are discussed. Also considered is sanitation within the plant with regard to water supply, food handling, etc. The chapter concludes with a review of the kinds and amounts of bacteria to be found in dehydrated foods. Six tables of data on this latter subject are included.

In the short chapter on dehydration costs, attention is directed primarily to labor costs, fuel costs, and equipment costs, with emphasis on the labor costs. The costs considered involve overall costs and not just those of drying only.

Of interest to dietitians is the chapter on the nutritive value of dried foods. Fourteen pages are used to discuss the vitamin contents of dried fruits, dried vegetables, dried milk, dried meat and eggs, and dried blood and beef serum.

The important problem of packaging and storage is reviewed in the ninth chapter, which includes important data on the equilibrium moisture content of some dried vegetables and of dried milk and eggs. Various methods of packing in an inert atmosphere are described. The requirements for proper packaging are specified.

In the last chapter the methods of analyzing the various dried foods are presented, together with the recommended procedures for reconstituting them for cooking.

For anyone who desires a general, overall picture of our present knowledge and practice of food drying, this book is recommended. The extensive lists of supplementary reading at the end of each chapter provide the reader with an opportunity to delve into any phase as deeply as he may desire.

Published by the Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y., and containing 302 pp., 6 x 9 in. in size, the price of the volume is $4.25.—*W. R. M., Jr.*

How Air Conditioning and Refrigeration Serve the War Effort

Engineers at the East Springfield plant of Westinghouse Electric and Mfg. Co. have prepared a listing of modern industrial problems. It points out how air conditioning and industrial refrigeration can improve the product (or operation) to make our war effort more effective. The following paragraphs list the process, the problem, and the solution:

1) *Machining Work.*—Too many rejects, cannot hold work within design tolerances, tools seizing and breaking, excessive coolant evaporation. Rash on workmen's hands.—Hold coolant temperature constant with automatically controlled refrigeration.

2) *Spectrographic Inspection.*—Erratic arc performance, distortion in spectrum photo, incorrect density values in spectrum lines, dust flecks on optics, deterioration of film.—Maintain proper conditions of temperature and humidity and remove airborne dust with air conditioning.

3) *Gage Testing.*—Inconsistent performance of master gage, cannot hold production gage in proper calibration. Gage and gage block surfaces rust.—Hold temperature constant and keep relative humidity at reduced point, with air conditioning.

4) *Electroplating and Anodizing.*—Cannot hold bath tem-

peratures down to required limits, plating quality and thickness vary.—Remove heat from bath by circulating refrigerated water through coils in bath.

5) *Optical Goods Grinding.*—Too frequent changes of pitch and lap setting required, lost time from skin rash, condensate on optics.—Hold temperature of room constant and filter out airborne glass dust with air conditioning.

6) *Optical Goods Assembly.*—Perspiration marks on optics, clouding between glasses, dust on optics, cement consistency varies.—Maintain relative humidity and room temperature at proper point with air conditioning.

7) *Flying Suit Storage.*—Skins dry out and crack, mildew on furs and fabric, moths feeding on fur and fabric.—Hold relative humidity at proper level and kill vermin with refrigeration.

8) *Hobbing Large Gears.*—Too great variance in measurements of gear blank during cutting, due to wide room temperature variations, condensate on gear teeth and tools.—Hold room temperature constant and keep relative humidity low with air conditioning.

9) *Instrument Assembly.*—Perspiration marks on highly polished surfaces, airborne dirt on small assembly parts, condensation and corrosion on parts surfaces.—Hold temperature and relative humidity at correct levels and filter out airborne dust with air conditioning.

10) *Testing Solid Shot.*—Unable to detect faults and internal stresses in visual inspection.—Immerse shot in alternate hot and refrigerated baths to make defects visible.

11) *Inspection Gaging.*—Too many rejects, gages inconsistent, dust and condensation on finely machined surfaces.—Control temperature and humidity and filter out dust with air conditioning.

12) *Instruction in Link Trainers.*—High internal temperatures in Link trainers make protracted training impossible. High temperature and relative humidity create perspiration hazard for controls and instruments.—Maintain room temperature and humidity at correct levels with air conditioning.

13) *Citrus Fruit Concentration.*—Aging and spoilage of concentrate after canning.—Refrigerate concentrate storage room.

14) *Parachute Storing.*—Mildew spots develop in 'chutes in storage. Too slow drying of 'chutes in drying room.—Maintain low humidity with air conditioning.

15) *Food Produce Storage.*—Excessive spoilage. High humidity causing mildew or too low humidity drying out produce.—Hold proper storage temperature and humidity with refrigeration.

16) *Spot Welding.*—Short life of welding tips. Too frequent cleaning of tips required. Poor quality of weld.—Cool welding electrodes by circulating refrigerated water through special electrode holders.

17) *Sandpaper Storage.*—Paper too dry, causing abrasive to become detached; paper too damp, causing deterioration.—Maintain humidity at proper level with air conditioning.

18) *X-ray Film Developing.*—Bath temperature too high. Lack of detail in developed films and inconsistent results.—Use controlled refrigeration to hold bath temperature at constant level.

19) *Capsule Manufacture.*—Humidity detracting from quality and form of capsule.—Provide correct humidity with air conditioning.

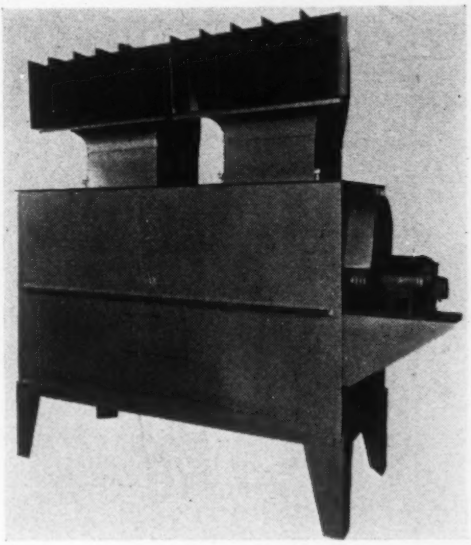
20) *Abrasive Wheel Manufacture.*—Binder compound consistency varies too much, batch weighing of abrasive ingredients not accurate. Drying time too variable—Hold room temperature and humidity constant with air conditioning.

21) *Packaging Dehydrated Foods.*—High relative humidity in packaging room causes too great moisture regain in dehydrated product.—Hold humidity at low point with air conditioning.

22) *Airfield Traffic Control.*—Tower temperatures too high for proper working efficiency. Instruments and equipment affected by high temperature and humidity.—Reduce tower temperature to efficient operating level and hold correct humidity with air conditioning.

23) *Industrial First Aid.*—Minor surgery rooms too

Blo-Cold
FORCED CONVECTION UNITS



Wherever
BLOWERS
do the job

★ In hundreds of installations where blowers are used—Acme units are giving satisfactory service. Users are satisfied with their performance.

In cold storage plants—in packing houses—in walk-ins—in apple and fruit storage—wherever blowers are the answer—Acme delivers all that the user expects.

The line includes various capacities to meet every requirement. Write for Catalog No. 32 for complete information. And if our engineers can help you—just let us know.

●

ACME INDUSTRIES
Jackson, Michigan

ACME PRODUCTS ★★★

A 7-YEAR RECORD of ECONOMY SATISFACTION and COMFORT

Here is an example of the type of service that wins friends for

GEHL STOKERS

IN 1935 The First Methodist Church of Milwaukee, Wisconsin, installed a Gehl Stoker. In 1936 they wrote:

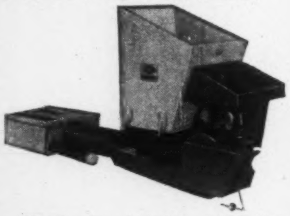
● ". . . The entire new system has worked to such advantage that we used about one-half the coal previously required . . ."

(The saving quoted for the first year was $365.33.)

IN 1943 The church wrote:

● ". . . the Chairman of our house committee estimates that the Stoker has more than paid for itself. In addition to the economy, it is a very great satisfaction and comfort to all our people."

*Copies of complete letters on request.



Models for factories, warehouses, public buildings, office buildings, apartment buildings, schools and churches.

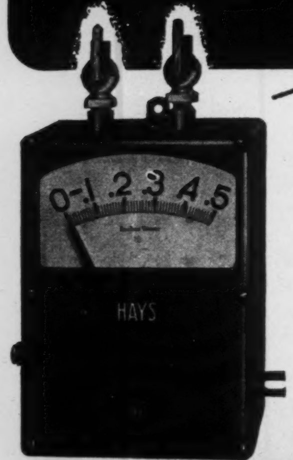
Write for catalog and our plan of dealer cooperation

GEHL BROS. MFG. CO.

Established 1867 Dept. BL-831 West Bend, Wisconsin

A GEHL WINS FRIENDS WHEREVER IT GOES

It's Easy TO SPOT DIRT CLOGGED FILTERS with a HAYS AIR-FILTER GAGE



Of course you know that air-filters must be cleaned or replaced, but when? The Hays Air-Filter Gage tells you exactly when dirt clogged filters are obstructing air flow, impairing operating efficiency, increasing power costs. The gage is easy to install . . . nothing to get out of order. It has been recommended by engineers for nearly half a century. Write 990 Eighth Ave., Michigan City, Ind., for A-F G. Bulletin and prices.

THE HAYS CORPORATION
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

warm, airborne dust creates infection hazard, patients uncomfortable.—Reduce room temperature to proper level; filter out dust with air conditioning.

24) *Instrument Storage.*—Too high or too low temperature and humidity affect efficiency and accuracy of delicate instruments.—Control temperature and humidity with air conditioning.

Plumbing Book Has Piping Data

A companion piece to the first volume, Vol. 2 of Plumbing Practice and Design, by Svend Plum, contains 11 chapters covering technical considerations embracing physical and chemical terms, codes, and architectural practice; discussion of pipe work; a presentation of water supply, piping, and heating; an outline of drainage, sewers, sewage disposal, and treatment; and information on gas piping and appliances.

The first chapter is designed to assist in the application of physical and chemical terminology to the art of plumbing. Unfortunately, the subject matter is frequently lost by the inclusion of discussions of certain phases of plumbing practice and certain of the definitions deviate from accepted standards. Omission of data on lignitic coals and natural gas, with which a large part of the country heats, also tends to reduce the widespread usefulness of an otherwise helpful chapter.

Considering only the material of most interest to HPAC's readers, the fourth chapter (pipe work) is a handy compilation of common piping definitions. It also contains many suggestions and rules for piping installation and tests. A worthwhile discussion on low temperature insulation aids in making this chapter a reference for basic data covering a part of the general piping field.

The fifth chapter's discussion of water supply covers a vast territory in a few strides. A concise treatise, it should be regarded only as a topical summary, not a full or by any means adequate presentation of the knowledge of the subject. It is a challenge to further study.

The discussion of water piping offers food for thought in its relation to the design of other piping systems. The

---

Statement of Ownership and Management of HEATING, PIPING & AIR CONDITIONING for October 1, 1943

The following is a statement of ownership, management, etc., as required by the Acts of Congress of August 24, 1912, and March 3, 1933, of Heating, Piping & Air Conditioning, published monthly at Chicago, Ill., for October 1, 1943:

State of Illinois, County of Cook, ss: Before me, a Notary Public in and for the State and county aforesaid, personally appeared F. P. Keeney, who, having been duly sworn according to law, deposes and says that he is the Publisher of Heating, Piping & Air Conditioning, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, F. P. Keeney, Chicago, Illinois.
Editor, C. M. Burnam, Jr., Chicago, Ill.
Managing Editor, C. M. Burnam, Jr., Chicago, Illinois.
Business Manager, Chas. E. Price, Chicago, Illinois.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

Keeney Publishing Company, 6 North Michigan Avenue, Chicago 2, Illinois. Stockholders: F. P. Keeney, Chicago, Illinois; W. J. Osborn, Fairfield, Conn.; R. Payne Wettstein, Chicago, Illinois; Chas. E. Price, Chicago, Illinois; Robert A. Jack, Cleveland Heights, Ohio.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

F. P. Keeney,
Publisher.

Sworn to and subscribed before me this 20th day of September, 1943.

Grace E. Waymire.

(SEAL) [My commission expires February 10, 1946] chapter on sewage treatment contains a handy (though necessarily brief) discussion of this important subject. The comments on gas piping and water heating should be of interest to a large group of readers.

Although written for the specific purpose of bringing engineering principles to bear on the art of plumbing practice, the volume contains much matter of interest to those engineers dealing in broader fields of piping.

This book contains 329 + viii pages, 5⅞x9 in., and sells for $4.50. The publisher is John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y.—*A. C. K.*

Oil Heating

Intended primarily as a text for home study of domestic oil burners, the book Domestic Oil Heating, by Fred Meyer, contains some information of a general nature on a number of topics of interest to heating engineers: petroleum, fuel oils and combustion; oil storage and piping; methods of atomization of light oils; electric controls and wiring circuits.

It is generously illustrated with cuts of typical burner mechanisms and related apparatus, and methods of installation. The exposition is prepared for persons having but little technical background or schooling. At the end of the text is a group of questions designed to test the reader's grasp of the subject matter. The book contains 104 pp., 5x7½ in., and is published by International Textbook Co., Scranton, Pa.—*K. S.*

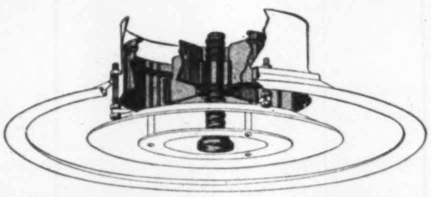
Flow Meter Engineering

The handbook Principles and Practice of Flow Meter Engineering, by L. K. Spink, widely accepted as a standard text and guide, has just appeared in a new and enlarged edition, the sixth since the book was first published in 1930. New and advanced phases of the subject are covered for the first time, bringing the book up to date and adding to its usefulness. The author is a member of the working committee which developed the latest AGA orifice meter

KNO-DRAFT K-NEWS

USING CONDITIONED AIR MOST EFFICIENTLY

Effective Air Diffusion is as important as any other function of air conditioning—and effective diffusion is insured with the KNO-DRAFT* type W-A-R Adjustable Ceiling Diffuser equipped with type DEE Volume Control.



Cutaway diagram of Kno-Draft Air Diffuser equipped with Type Dee Air Volume Control*

Patents Pending

This Unit provides draftless, noiseless, uniform air diffusion, thorough air mixing, room temperature equalization, greater air volume with lower resistance. Most important —both the air *direction* and the air *volume* are adjustable. Descriptive Folder P on request.

**Formerly known as Dorex Kno-Draft Air Diffuser*

WB CONNOR

W. B. CONNOR ENGINEERING CORP.

114 East 32nd Street New York, N. Y.

ENGINEERED TO CUT COSTS

The high efficiency rating of SCV Pumps is not an accident—*it is the result of over 30 years' specialized experience,* modern plant equipment and highly skilled craftsmen. Thus the lower maintenance and operating costs of Economy Pumps are a measurable gain, assured by precisely engineered features, such as:

1—High motor mounting—above floor splash and dirt.

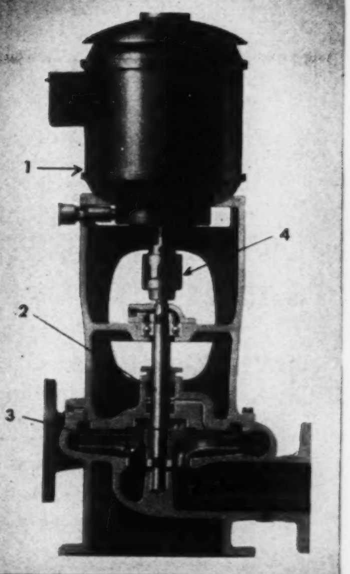
2—Accessibility—complete rotor removable without breaking pipe connections.

3—Smooth operation—impeller spins between two bearings.

4—Flexible coupling—accessible stuffing box.

5—Standard motor—avoids prolonged shutdown as any stock motor is usable.

6—Handles all clear liquids—10 to 500 GPM.



Write for New Pump Data Book
Indispensable to Plant Executives and Engineers. Sent Free. Simply write for copy on your letterhead.

ECONOMY PUMPS, Inc.

HAMILTON, OHIO

G&O COILS

G&O
RADIATION

FOR HEATING AND COOLING IN A WIDE RANGE OF SIZES

Send for Catalog

Detail of mechanical joint used in Universal Heat Transfer Coils.

THE G&O MANUFACTURING COMPANY

New Haven, Connecticut

Pioneer Manufacturers of Square Finned Tubing in the United States

HIGH CAPACITY
AT LOW COST

V-300
LOW PRESSURE
GAS REGULATORS

GENERAL CONTROLS V-300 gives continuous, efficient operation at low cost. This compact low pressure gas regulator is built to last... Available in correct materials for handling natural, manufactured and L. P. gases... the V-300 is furnished in sizes ranging from 3/8" to 2" I.P.S... Standard outlet pressures range from 2" to 5"; factory setting 3½" for average appliance use. Write for Catalog No. 52 with complete specifications.

GENERAL CONTROLS
801 ALLEN AVENUE • GLENDALE 1, CALIFORNIA
Branches: Boston • New York • Philadelphia • Cleveland • Detroit
Chicago • Dallas • Denver • San Francisco

DE-STA-CO
Blower Wheel Housings
of Standard Dimensions

Made in sizes to fit 4½, 5, 6, 7½ and 9 inch wheels and in widths to suit single or double inlet wheels . . . also individual parts for your own assembly.

De-Sta-Co housings are engineered for maximum efficiency and quietness in operation . . . neatly finished. Send for "De-Sta-Co Blower Housings" bulletin; gives complete information, including essential dimensions.

DETROIT STAMPING CO.
Established Over 25 Years
337 Midland Ave • Detroit 3, Mich.

tables, a member of the ASME fluid meter research committee, and of the joint AGA and ASME pulsation research committee. As an engineer who has devoted many years to the study of flow measurement, he is well qualified to handle the subject.

The book, 232 pp. in length, is illustrated with photographs, diagrams and curves, and contains all the tables and formulas needed for any ordinary liquid or gas flow computation. In the liquid section, methods for determining compressibility factors of liquids at temperatures near the critical, a new and more accurate method of correlating temperature expansion data on petroleum oils, a quick method of correcting for tap locations, and a shortcut method of correcting for viscosity, are some of the features.

The gas section suggests several methods of correcting for viscosity effects. Theoretical discussions, as well as working equations and tables for moisture and supercompressibility, are presented. A new type of intermediate pressure device which eliminates the bypassing of gas is described. The latest findings on the measurement of pulsating gas flows are covered.

Published by the Foxboro Co., 106 Neponset Ave., Foxboro, Mass., the price of this book is $3.00.

AGA Issues Comprehensive Report on Gas Summer Air Conditioning

The American Gas Association testing laboratories, 1032 E. 62nd St., Cleveland 14, Ohio, and 1425 Grande Vista Ave., Los Angeles 25, Calif., issued last month research bulletin No. 18 on gas summer air conditioning. The work reported in this bulletin was conducted under the supervision of the AGA's technical advisory committee on gas summer air conditioning research, of which G. E. May, New Orleans Public Service, Inc., is chairman.

The bulletin is a most comprehensive treatment of the subject, comprising 134 + viii pp., 8½ x 11 in., with a paper cover, and it has numerous illustrations and graphs. It is the first formal publication on the subject by the AGA testing laboratories.

The scope and objectives of the investigation are stated and a brief historical background is presented of activities to date in development and application of gas summer air conditioning equipment. Contemporary designs now available are described together with test apparatus employed for determining their performance. Servicing details and operating costs are discussed.

Complete test data resulting from 80 cooling capacity tests on four units are shown. These are produced by three different manufacturers each employing widely different features of design and operation. Tables and graphs are included to show flexibility of the units tested under field conditions normally encountered in the United States. Durability, substantiality, and safety of operation are also demonstrated by test results.

A section on general air conditioning technology lists definitions, fundamentals, calculations, and explanations of air conditioning processes.

The scope of the investigation is well-stated in the introduction to the bulletin, as follows:

When, in 1941, the executive board of the American Gas Association authorized a research and testing project on gas summer air conditioning equipment at the association's laboratories in Cleveland, nation wide recognition was focused on the growth of a new industry. This action reflected the popular desire for satisfactory cooling and dehumidification of residences and small commercial establishments. It also constituted a response to increasing demands of many leaders of the gas industry for gas summer air conditioners to partially balance the gas sendout for house heating in the winter.

Equipment of various kinds using gas heat for adsorption dehumidification, for absorption refrigeration, and for gas engine compressor drive had been manufactured or under development for nearly 15 years. A few developments had been field tested and rejected. Others had been in successful operation in certain applications. Still others were reported to be making good progress and holding hope of good results and there were rumors of further new developments in the laboratory stage. None of them, however, had been generally accepted so that mass production could be started. Progress toward the desired goal seemed to be slow.

Many other questions were raised about the prospects for general availability of gas summer air conditioning. Among them were the following: Are manufacturers conducting enough actual research and development toward perfection of equipment? Can gas air conditioning compete with other types of equipment? What will this new equipment offer that is not already available? What revenue can be expected from increased gas sales for summer air conditioning? Is it larger or smaller than that expected by other utilities from increased use of water and electricity for the operation of gas air conditioning equipment?

Being familiar with these questions and others, the technical advisory committee on gas summer air conditioning research, at its organization meeting on April 17, 1941, agreed upon the scope and procedure for work to be carried on under its direction and decided that:

1) A qualified member or members of the laboratories' staff be permanently assigned to direct, coordinate, and conduct the work done by the laboratories.
2) A survey of existing available technical data be undertaken immediately, together with factory visits for inspection of apparatus, for appraising the laboratory facilities of each manufacturer, including discussions with manufacturers relating to their expectations as to present and future markets for respective types of equipment, and consultation with individual members of the technical advisory committee.
3) Such economic and market data be assembled as are necessary for evaluating relative importance of performance characteristics and economics of representative makes of equipment.
4) A preliminary report of findings be submitted to the technical advisory committee together with recommendations developed therefrom on scope and details of further investigations, including nature and extent of any tests considered necessary at AGA laboratories or in manufacturers' plants.
5) A budget for any testing work deemed necessary on each make of apparatus be submitted.
6) Main investigation be limited to comfort application in residential and small commercial classifications, of size not exceeding 25 tons, but with provisions for later extension to include larger installations for other applications if found advisable.
7) Formulating of complete permanent program be held in abeyance by committee until above mentioned preliminary report and recommendations by laboratories are received.

These instructions were carried out and findings were summarized in detail and interpreted in a laboratories' report No. 938-A, which may be regarded as an audit of gas summer air conditioning as it had been developed up to June 1941. Briefly, this survey indicated that a summer air conditioning load is important to the gas industry; vast markets for equipment exist and public demand for air conditioning is increasing; gas actuated equipment for meeting this demand is available and, with reductions in initial cost made possible through mass production, this equipment can compete with systems operated with competitive energy; and an increasing number of gas companies are actively developing these markets. Recommendations for conduct of investigations of the committee were also included for its consideration. With minor modifications these recommendations were adopted by the technical advisory committee in July 1941, and a program of testing available equipment of contemporary design under controlled laboratory conditions was inaugurated as the first step in the consummation of this outline. The major objectives of this assignment were as follows:

1) Proceeding with laboratory tests on available contemporary gas summer air conditioning equipment for the purpose of verifying manufacturers' claims, determining effects of various operating conditions on cooling and dehumidifying characteristics, and determining safety and durability of gas utilization equipment.
2) Collecting of field cost and performance data covering installations in territories of several cooperating gas companies for analysis.
3) Setting up mechanics by which the committee and the testing laboratories can be of maximum help to the industry by serving as a clearing house of information to pass on to the industry valuable data and experience gained in the field by utilities and manufacturers.

The first and third objectives have already been attained. The second is to be the subject of a separate report as soon as analyses of data received have been completed.

In attaining the first of these objectives, the following equipment was secured from manufacturers and subjected to tests and observation:

Servel CHA3-12 all year air conditioner.
Servel CHA5-12 all year air conditioner with model TB-15 water cooling tower.

Another WING *Product*

WING REVOLVING UNIT HEATERS

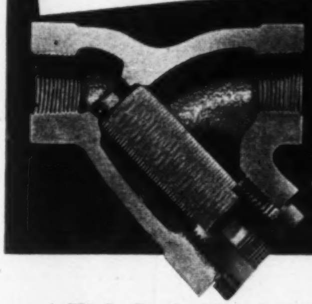
Wing Revolving Unit Heaters insure uniform mixture and circulation of heated air by the use of discharge outlets which revolve slowly and project the streams of heated air to the working level sweeping around in a complete circle. As the moving air circulates along the working level, it mixes uniformly with the cold air, circulates around heavy machinery and obstructions and penetrates into cold, damp corners—insuring a comfortable uniform temperature throughout the entire plant. These Wing Revolving Heaters are suitable for all types and sizes of buildings because the deflectors on the discharge outlet can be adjusted to propel the air in two different concentric circles which permits coverage of a great area.

L. J. Wing Mfg. Co.

14th St. & 7th Ave., New York, N. Y.—Factories: Newark, N. J.

Prevent RUST · SCALE · DIRT
From Clogging Steam Equipment

YARWAY
STRAINERS
"The Screen's the Thing"



- ***A High Grade Monel Woven Wire Basket*** **with mesh fine enough to catch the dirt—yet ample free area for passage of clean condensate, oil and other fluids.**
- ***Body Cadmium Plated Inside and Out for Protection Against Corrosion***
- ***Readily Removed Steel Blow-Off Bushing***
- ***Bushing Automatically Aligns Screen***
- ***Thousands in Use—Sold by Over 100 Mill Supply Houses***
- ***6 Sizes ½" to 2" for Pressures up to 600 Lbs.***

See Your Supply House or write for Bulletin S-200

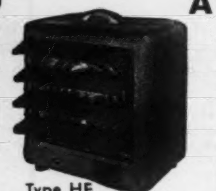
YARNALL-WARING COMPANY
107 Mermaid Avenue PHILA. 18, PA.

Quick way to provide heat for new shops or offices—

Economical electric heat is the easy answer to any heating difficulty. With Chromalox electric air heaters, installation becomes a simple wiring job instead of a matter of complicated pipe layout. You cut out many troubles with

Type CUB
Four Sizes
15 to 40 Kw.

Type UB
2 to 15 Kw.



Type HF
1.5 to 4 Kw.

CHROMALOX Electric
AIR HEATERS

They easily bring heat to remote or isolated spots, such as gate houses . . . They put no added demand on overloaded boilers . . . They work any time, and are lifesavers when boilers are shut down, as on Sundays or other off-peak periods . . . Wide range of types, heating with blower-driven warmed air, or by convection. Use them in the fall and spring instead of steam heat. Check with us on operating cost, size and type of units for your job.

Write for the Chromalox Catalog of Electric Heat, fully describing these air heaters, and also the many Chromalox units for industrial heat. On request.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh 8, Pa.

GOT A WATER SCALE PROBLEM?

Solve it with SOL-VET "08"

• **SOL-VET "08"** is a fast, efficient cleaner of scale, rust, slime, dirt, algae for all equipment using water for cooling. By dissolving impurities completely, they are carried out *in solution,* thus preventing clogging. Head pressures fall to normal; heat transfer is raised to maximum; full circulation is restored; life of equipment prolonged. On large jobs, shutdown time is cut to a maximum of 6 to 8 hours.

GUARANTEED EFFECTIVE
If you find SOL-VET "08" not exactly as represented, when used according to instructions and full, accurate report is given within 30 days from date of purchase, your money will be refunded.

GUARANTEED HARMLESS
when used as directed, to all water conducting materials in water cooled equipment.

MAIL COUPON NOW
for complete data, and analysis and recommendations for your specific problem. No obligation, of course.

FILL IN AND MAIL COUPON
you're not obligated

ANDERSON-STOLZ CORPORATION
1731 WALNUT ST. KANSAS CITY, MO.

☐ Please send complete data on SOL-VET "08."
☐ We are forwarding water sample and mechanical data—please send analysis and recommendations.

NAME__________
FIRM__________
ADDRESS__________
CITY & STATE__________

SOL-VET "08"
Water Treatment Formula
Manufactured and Guaranteed by
ANDERSON-STOLZ CORP.
1731 WALNUT STREET
KANSAS CITY, MISSOURI

Williams "Air-O-Matic" 7 ton absorption unit.
Bryant No. 15R dehumidifier, dry air cooler, and "resaturator" assembly.
Mills 3 ton absorption refrigerator and air conditioner.

The bulletin summarizes the results of the research work, as follows:

1) Results of tests on representative sizes of Bryant, Servel, and Williams gas summer air conditioners showed generally satisfactory performance over greater extremes of inlet air temperature and humidity than would normally be encountered in service. Cooling capacity ratings established by the respective manufacturers were verified.

2) All systems mentioned above were found to comply with applicable national requirements for safety, durability, and substantiality.

3) Both operating and initial costs of gas summer air conditioners tested are within competitive range of equipment using other sources of energy. All-year air conditioning, lower maintenance, possibility of more flexible control and dependability, are advantages in favor of gas fired units.

4) Several unsatisfactory operating characteristics disclosed by these tests were reported to the respective manufacturers and were confirmed by field experience of several gas companies. This resulted either in immediate improvement of equipment or further study to work out the developments required. Principal individual recommendations were as follows:

First unit:
Automatic removal of non-condensable gases or relocation of purge.
Use of a superior solvent with less tendency to solidification.
Improvement in evaporator design.
Simplification of controls.

Second unit:
Improvement in solution transfer balance valve.
Use of a refrigerant other than ammonia.
Design for indoor installation.
Reduction of corrosion.

Third unit:
Decreased size and weight of existing unit.
Redesign to include boiler, cooling coils for air, and blower.

Fourth unit:
Decreased noise of operation.
Reduction of water and electrical energy consumption.

5) As a result of this investigation the laboratories through their present facilities, trained personnel, and contact with field conditions (through the joint committee on summer air conditioning) are now in possession of considerable technical information on gas summer air conditioning equipment which is available to the industry.

6) Additional research in laboratory and field is recommended on such subjects as basic design and construction details of duct systems for residences; water softening materials and devices for cooling towers and boilers; a refrigerant solvent combination capable of general application; methods and equipment for control of humidity independent of temperature; and conservation of cooling water.

New Standard Recommends Limit On Arsenic Fumes in Workplaces

The increased use of arsenic in industrial processes due to the needs of war production, and the consequent increased danger of arsenic poisoning of workers, has resulted in approval by the American Standards Association of an American war standard which defines the safe amount of arsenic fumes in the air of work places. The standard recommends a maximum allowable concentration of metallic arsenic and arsenic trioxide of 1.5 milligrams (calculated as As) per 10 cubic meters of air.

The new American war standard is intended to apply only to the emergency period of the war. After the war, the standard will be reconsidered by the ASA sectional committee on allowable concentrations of toxic dusts and gases and will be approved as a regular American standard or will be dropped if it is decided that it is no longer needed.

Copies of this standard are available from the ASA, 29 W. 39th St., New York, N. Y., for 20c.

• WPB . . . OPA . . . PAW . . . Etc. •

WPB Revises Regulation on L and M Order Appeals

A revision of priorities regulation No. 16, governing the filing, granting, and denial of appeals from various L and M orders of the War Production Board, was issued October 8.

Of principal interest to manufacturers is the new list A to the regulation, enumerating orders from which appeals must be filed with WPB regional offices. This list includes more than 180 such orders and is further evidence of WPB's continuing decentralization.

*L-22—Furnaces.
*L-38—Industrial and commercial refrigeration and air conditioning machinery and equipment.
L-42—Plumbing and heating simplification.
L-74—Oil burners.
*L-75—Coal stokers.
L-79—Metal plumbing and heating equipment.
*L-100—Compressors.
*L-106—Copper.
*L-107—Extended surface heating equipment.
*L-123—General industrial equipment.
*L-126—Industrial and commercial refrigeration and air conditioning machinery and equipment.
*L-163—Turbo-blowers.
*L-172—Heat exchangers.
L-173—Oil and gas burning space heaters.
*L-176—Domestic and commercial electric fans.
L-185—Water heaters.
L-187—Low pressure cast iron boilers.
L-999—Plumbing and heating tanks.
*L-221—Electrical motors and generators.
L-225—Electrical conduit, electrical metallic tubing, and raceways.
*L-246—Pumps.
*L-250—Electric motor controllers.
*L-280—Fans and blowers.

---

*Until November 1, 1943, notwithstanding paragraph (b), an appeal from a listed order marked with an asterisk shall be filed where the order directs. On and after that date such an appeal shall be filed with the field office of the War Production Board for the district in which is located the plant or branch of the appellant to which the appeal relates.

WPB Clarifies Allotment Number Use for Class A and B Products

The distinction between the use of allotment numbers for identification purposes by class A and class B product manufacturers has been clarified through the issuance of interpretation 19 to CMP regulation 1, the War Production Board announced October 8.

A manufacturer of a class B product ordering production material needed to make the class B product must use the allotment number identifying his allotment and authorized production schedule in placing orders for such production material. Such manufacturers must not use the allotment numbers appearing on orders placed with them by their customers.

For example, a manufacturer of electric motor controls receives an allotment of controlled materials identified by the allotment number J-3 from the WPB, together with a preference rating. When he orders production material to make electric motor controls, he will use the symbol J-3 on his orders. Orders for electric motor controls placed with him by his customer will bear allotment numbers such as B-4, W-3, G-6, U-1, and others. The electric motor control manufacturer may not use those allotment numbers in placing orders for the production material for the manufacture of the controls.

Manufacturers of class A products, however, receive allotments from their customers, rather than from WPB, and therefore use the allotment numbers appearing on such

DOES NOT STAIN HANDS or FIXTURES

Take a tip from other master piping contractors and plant engineers and use Rutland Pipe Joint Cement on every job. It seals joints tightly—lasts indefinitely—yet always leaves pipes easy to disjoin. Legal for use in all cities because no toxic ingredients. Remains soft in can.

Mail post card for free sample. Rutland Fire Clay Company, Department H-18, Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patchers.

RUTLAND
PASTE PIPE JOINT CEMENT
RUTLAND FIRE CLAY CO
RUTLAND, VT

"FABRICATING METHODS"

"HOW TO MAKE DUCTS FROM NON-METALLIC MATERIALS"

Is Yours for the Asking

SHEETLOCK
the Modern Method of Lock-Joining Non-Metallic Boards
FABRICATING METHODS
-the Self-Fastening Strip
Manufactured by
SHEETLOCK COMPANY
4521 N. CLARK ST.
CHICAGO, ILL.

It has been proven, and we are of the firm opinion that the methods used in "FABRICATING METHODS" make the best ducts possible and at the same time at the very lowest cost. This eight-page booklet describes the latest improved methods of fabricating flexible or rigid non-metallic boards.

Write today for this illustrated informative booklet.

THE SHEETLOCK COMPANY

Manufacturers of Sheetlock Self-Fastening Metal Strip

4521 North Clark Street Chicago, Illinois

CLEAR YOUR PLANT OF
WELDING FUMES!

GUARD EMPLOYEE HEALTH by installing Ruemelin Fume Collectors wherever welding operations take place. They remove noxious gases, heat and smoke at the source . . . eliminate employee fatigue . . . speed up welding operations. Especially valuable in winter when doors and windows must be closed. Hundreds in operation all over the country. Write for bulletin No. 37-C.

RUEMELIN MFG. CO., 3896 N. Palmer St., Milwaukee 12, Wis.

RUEMELIN FUME COLLECTOR

POWERS
INDICATING
and
RECORDING THERMOMETERS

Some of the many different types of Dial Indicating and Recording Thermometers we make are shown here. We also make Recording Regulators and Regulators combined with easy to read Indicating Thermometers. **Write for Bulletins.** Specify type of instrument in which you are interested.

THE POWERS REGULATOR CO.
2759 Greenview Avenue, CHICAGO
Offices in 47 Cities—See your phone directory

50 Years of Temperature and ★ Humidity Control ★

customer's orders when they order production material needed to make class A products. For example, a manufacturer of a class A product who receives an order from a customer and an allotment of controlled material identified by the allotment number 0-5, will use the same allotment number 0-5 in placing his orders for production materials needed to manufacture the class A product. If he receives an order for his class A product from a manufacturer of a class B product with an allotment, identified by the allotment number J-3, he will use this number in placing his orders for production materials.

The interpretation also calls attention to the fact that an allotment number or symbol alone never constitutes an allotment of controlled materials. In making an allotment, a consumer must specify the controlled material and the exact quantity allotted, and under paragraph (f) of CMP regulation No. 1 allotments must be made only in the form and shape in which they are allotted to the persons making the allotment.

P-89 On Maintenance, Repair and Operating Supplies Amended

Preference rating order P-89, governing maintenance, repair, and operating supplies, was amended recently by the War Production Board to conform with priorities regulation 3, which covers the uniform method of application and extension of preference ratings.

The amended order P-89 restates the definition of maintenance, repair, and operating supplies as including "minor capital additions, the cost of which does not exceed $500, excluding the producer's cost of labor, for any one complete addition which has not been subdivided for the purpose of coming within this definition," and adds:

"In case of rearrangement of an existing installation, or in the case of adaptation of an existing installation to a different process, only the material added to the existing installation need be considered in computing the $500."

The revised order adds a new sub-paragraph in paragraph (g) so that the lists attached to priorities regulation 3 will limit the use of P-89 ratings, instead of specifying various prohibited articles in P-89. It also continues the quotas which have already been established for the fourth quarter of 1943 under the system which existed previously.

A flat AA-1 rating and allotment symbol MRO P-89 are provided after January 1, 1944, with the restraining provision that the aggregate dollar value of purchase orders for materials for maintenance, repair, and operating supplies placed by the producer during the calendar year 1944 may not exceed the dollar value of purchase orders for such materials placed by the producer during the calendar year 1943. This change was made for the purpose of dispensing with the requirement for future filing by producers of quarterly applications on form WPB-1765.

The small order exemption for purchases of aluminum in any quarter has been raised from 100 to 500 lb.

No substantial change was made in the type of information required when making specific application for materials which are not obtainable under the quotas. However, the revised order specified the information required when applying for special ratings for containers.

Maximum Length of Refrigerant Connections in L-126 Changed

The maximum length of refrigerant connections for which copper or copper base alloy pipe or tubing may be used was changed from 15 to 25 ft by amendment I to schedule VI of limitation order L-126, issued September 30 by the War Production Board. Other provisions of schedule VI (required specifications for refrigerant and service connections) remain unchanged.

Valve and Pipe Fitting Orders L-252 and L-278 Amended

Producers of valves for use as part of the equipment of aircraft or watercraft other than pleasure craft are relieved of the requirement of having firm orders as a prerequisite for making such valves through amendment No. 4 to the WPB's limitation order L-252 issued recently. Amendment No. 1 to order L-278 removes the words "which are ordered" from definitions of pipe fittings excluded by reason of end use from the provisions of the order. This amendment removes the prerequisite of having firm orders on hand in order to exclude from WPB restrictions those pipe fittings for use on aircraft or watercraft; for conducting dangerous liquids or gases; and for replacement purposes.

National Fuel Efficiency Council To Promote Conservation

Supplementing the government's nationwide critical resources conservation campaign, Secretary of the Interior Harold L. Ickes announced last month the launching of a fuel efficiency program to combat wasteful practices in the use of coal, coke, wood, petroleum, and gas. Emphasis will be placed first on commercial and industrial plants, with the program to be expanded later to include small consumers, home owners, and others.

He said that Dr. R. R. Sayers, director of the Bureau of Mines, has named from private industry a national fuel efficiency council of 12 engineers outstanding in the field of fuel utilization to chart and direct the campaign in cooperation with the Bureau of Mines.

Tentative plans call for the organization of subcommittees of engineers to carry out the program at regional and local levels. Hundreds of engineers already have expressed their willingness to cooperate. The assistance of national engineering societies and other organizations also is being sought.

The council will depend primarily upon education and training of industrial and domestic consumers to achieve results.

The initial appeal will be made, largely by personal approach of local engineers, to commercial and industrial users. Group meetings among national trade and professional organizations also are expected to help.

Preference Given to Anthracite Orders For Heating Poultry Brooders

As a step in assuring uninterrupted operation of one of the nation's essential food supply industries, Solid Fuels Administrator for War Harold L. Ickes last month issued a regulation giving a preference to orders for pea and chestnut anthracite for heating poultry brooders and hatcheries.

The regulation, No. 5, affects purchases from producers, wholesalers, and retailers of anthracite. Producers and wholesalers are directed to give preference to orders for carload or truckload lots while retailers are instructed to give preference to orders of any tonnage.

Stop Industrial Fuel Oil Conversions

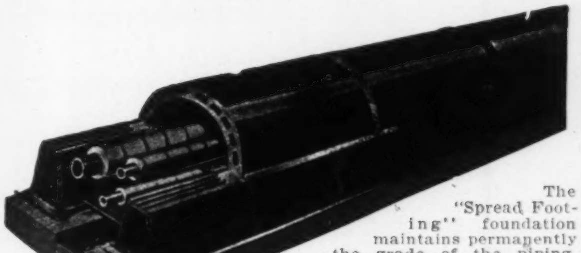
Petroleum Administrator for War Harold L. Ickes announced October 19 that industrial fuel oil consumers throughout the country who were in process of converting their burners to substitute fuels might suspend their conversion activities.

The action primarily affects industrial consumers in the 17 east coast and 15 midwestern states, and applies only to users of the heavy, residual type fuel. PAW emphasized that heating oils of the distillate type—the kind used in home heating—continue to be short, and that there should be no relaxation in efforts to conserve that product. There is every prospect that the shortage of home heating oils will continue, because, with the increasing amount of each barrel of crude that must go into petroleum war products, it is not possible to expand materially the volume of distillate, said PAW.

Administrator Ickes said that the industrial fuel oil situation has eased sufficiently so that now enough oil is available to meet the present requirements of consumers.

INSURE DRY INSULATION
in your underground piping. Use the Internal Channel Drain and Concrete "Spread Footing" Foundation that comes with

THERM-O-TILE
Reg. U. S. Pat. Off.



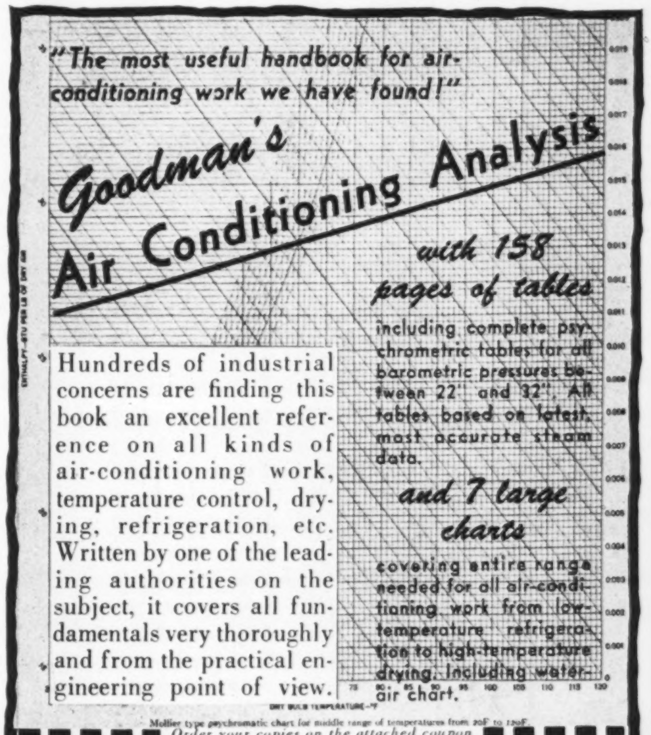
The "Spread Footing" foundation maintains permanently the grade of the piping. Crushed stone eliminated. Powerful arched construction. Competitive in final cost. Ask for Bulletin 381.

Sold and installed by Johns-Manville Construction Units in all Principal Cities. See our page in Sweet's or The Heating Guide.

H. W. PORTER & CO., Inc.
822-H Frelinghuysen Ave. Newark, New Jersey

Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job, on which we shall be glad to have your ☐ comments, ☐ quotations.

Clip your name, firm, and address to this ad; tear out with the checked squares above, mail, and you will hear from us promptly.



"The most useful handbook for air-conditioning work we have found!"

Goodman's Air Conditioning Analysis

with 158 pages of tables

including complete psychrometric tables for all barometric pressures between 22" and 32". All tables based on latest, most accurate steam data.

and 7 large charts

covering entire range needed for all air-conditioning work from low-temperature refrigeration to high-temperature drying. Including water-air chart.

Hundreds of industrial concerns are finding this book an excellent reference on all kinds of air-conditioning work, temperature control, drying, refrigeration, etc. Written by one of the leading authorities on the subject, it covers all fundamentals very thoroughly and from the practical engineering point of view.

Mollier type psychrometric chart for middle range of temperatures from 20F to 120F.

Order your copies on the attached coupon

The Macmillan Company, 60 Fifth Ave., New York 11, N. Y.

Please fill my order for..............copies of Goodman: AIR CONDITIONING ANALYSIS ($6.00).

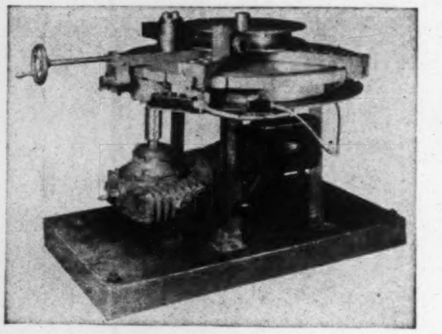
☐ Please bill me. ☐ Payment herewith.

Signed..

Address..

HP

PEDRICK BENDERS SAVE MONEY



Pedrick Model C-2 Pipe Bender for 3" pipe.
(Also made for pipe up to 6" Dia.)

It is cheaper to bend pipe than it is to buy fittings. It is quicker too, and every man-hour that you save on the job is a nail in Hitler's coffin.

Write for information on our time and money saving plan for piping installations.

PEDRICK TOOL & MACHINE CO.
3640 N. Lawrence Street, Philadelphia 40, Pa.

3 WAYS TO SAVE FUEL

- Start heating each morning as late as outside temperatures permit to have the building comfortable at the desired time.
- Maintain an even, comfortable, and healthful temperature throughout the day.
- Shut off heating at night as early as the weather permits.

The Marsh Tri-trol Regulator, an outside type heating control, *is the only control that does all three* AUTOMATICALLY.

Write today for full details on how the Marsh Tri-trol Regulator will reduce heating costs for you and save fuel for Uncle Sam.

MARSH TRITROL COMPANY
600 So. Michigan Ave., Chicago 5, Illinois

OPA Ends Convertibility Test for Fuel Oil Rations

Fuel oil rations will be granted to consumers using more than 10,000 gal annually regardless of whether their equipment can be altered to the use of coal, the Office of Price Administration announced October 1. This marked the last of several steps taken since May to suspend the year-old conversion program.

Last August 24, OPA announced that all buildings using less than 10,000 gal for heating purposes in 1942-43 would received their 1943-44 fuel oil allotment regardless of whether their burners were technically convertible to coal. Last month's action removes all conversion requirements on buildings whose equipment used more than 10,000 gal of fuel oil during the last heating season.

A number of factors entered into the decision to end the conversion program, OPA said. These include a slight improvement in the oil supply, a dropping off in the coal supply, and the conversion of enough equipment from fuel oil to coal to effect an annual saving of about 70 million barrels of fuel oil. Although the fuel oil situation remains serious, the supply of coal is at a point where the short supplies of both, in relation to existing heating equipment, are in balance. In this situation it is desirable to suspend the program of converting equipment from oil to coal, said OPA.

Although all consumers will receive fuel oil rations for 1943-44 without regard to convertibility, users are not eligible for an oil ration this year if, by September 24, substantial work had been done to alter their equipment or if by that time conversion of the equipment had already been completed.

The first relaxation of the restrictions which limited the issuance of rations to consumers able to convert to coal came last May 10. At that time, OPA announced the removal of all "convertibility tests" for obtaining supplementary heating rations in the 33 eastern, middlewestern and Pacific northwestern states under fuel oil rationing.

Overall suspension of the conversion program was further reflected in a recent announcement by the Petroleum Administration for War of the discontinuance of its program for the conversion of industrial oil burning equipment to the use of coal.

Recent Amendments to Fuel Oil Rationing Order

An index to amendments Nos. 1 to 50 to the fuel oil rationing order appeared on pp. 171-172 of the April HPAC. Amendments 51-60 were covered on p. 233 of the May HPAC, amendments 61-65 on p. 52, front section, June; amendments 66-71 on pp. 411-412, August; amendments 72-73 on p. 466, September; and amendments 74-78 on p. 537, October. The following information on amendments 79-82 has been taken from OPA fuel oil industry letters issued last month:

Amendment 79, effective September 25, 1943, amends several sections of the regulations. It clarifies the definition of primary supplier. An exception to the "first person in possession" rule exists if the seller of the fuel oil maintains a regular place of business within the limitation area. By interpretation this exception was construed to require the placing of the order *at the place of business within the area*. This interpretation is now added explicitly. A definition is provided for the term "ration credits," necessitated by the extension of ration banking to the fuel oil program. The regulations require dealers to state on their registration applications the amount of their fuel oil storage capacity in use at the date rationing commenced or at the date they began business, if later. The phrase "in use" has been misconstrued to include facilities used only for "throughputs," which has resulted in an over-issuance of inventory coupons or exchange certificates. To avoid the inclusion of such facilities and at the same time to require adjustment of registrations in which such facilities were included, certain changes are made in the regulations by this amendment.

Amendment 80, effective September 15, 1943, provides: First, that boards may issue rations for domestic cooking and lighting for periods up to one year instead of six months, and dispenses with the necessity for entering dates of issuance or expiration on coupon sheets representing these rations. Second, to reduce over-issuance, it has been deemed desirable to fix a maximum amount of a combined cooking and heating ration for use in a space heater used for both heating and cooking purposes. Third, it increases the domestic cooking "ceiling" for the first seven persons to 30 gal per month from the previous 20 gal per month for five persons, and 24 gal for six to seven persons, because it was found that the maximum amount allowable solely for cooking was inadequate.

Amendment 81, effective October 4, 1943, provides for granting fuel oil rations to owners of new space heaters in the 20 western counties of Idaho who acquired this equipment before August 24, 1943, when stove rationing became nationwide, thereby bringing this region into conformity with all other regions in the fuel oil limitation area.

Amendment 82, effective October 4, 1943, provides for the completion of Table 1-D, containing percentage adjustment to obtain normal consumption and maximum and minimum rations by heated floor area and by sub-zones in Washington, Oregon, and Idaho. This amendment adds the sub-zones 29A (Adams county, Idaho) and 30A (Valley county, Idaho).

"Bail-Out" Amendment to Fuel Oil Order Announced by OPA

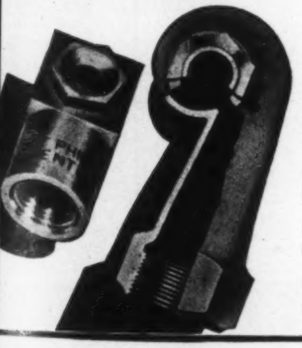
One of the most important amendments to fuel oil ration order 11 from the standpoint of the industry will become effective on November 1, 1943, the fuel rationing division of OPA said last month. It will establish a procedure whereby primary fuel oil suppliers and dealers may correct deficits or overages of ration evidences and bring their ration accounts into balance, as well as provide for certain aids which will assist distributors in keeping their ration accounts in balance in the future, according to the announcement.

Retail Coal Dealers Asked To Spread Available Supplies

Retail bituminous coal dealers are being urged by the Solid Fuels Administration to spread available supplies of coal among their customers to insure that all receive an equitable share.

Current heavy demands for coal for the iron and steel industry and for shipment during the navigation season on the Great Lakes are temporarily restricting the amount available for domestic use.

Such cooperation by the dealers will assist materially in carrying out the SFA's fuel distribution program and should be helpful in eliminating the need for many regulatory orders, it said.



YARWAY
INVOLUTE NOZZLES

The preference for trouble-free air washing service—because there are no internal parts or vanes to wear or clog. Proven through many years of service in water cooling and air conditioning installations totaling more than 5 million g. p. m.

Made in sizes and types for all requirements. Ask for Bulletin N-616.

YARNALL-WARING CO.
107 MERMAID AVENUE, PHILA. 18, PA.

STOP
Wasting
Time!

Don't Clean Traps Manually

It's a waste of TIME, MONEY, MAN HOURS and FUEL to clean traps manually because you don't get the sludge out of every part of the system and a moment after you've finished, the trap may be clogged again.

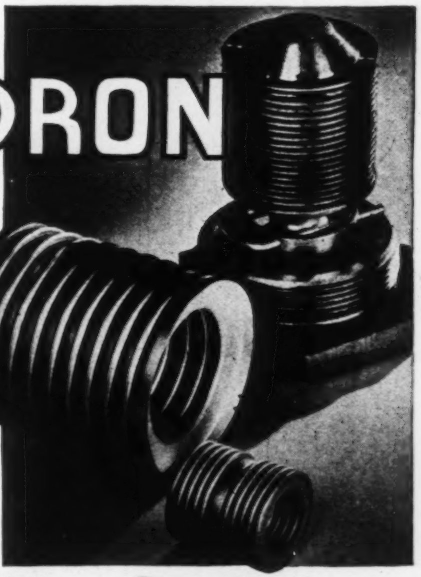
Clean traps the Rid-Sludge way . . . the scientific and safe way that drives sludge out of the entire system and keeps the system at top operating efficiency because it keeps sludge on the move.

When you use Rid-Sludge you don't have to shut down the plant nor use precious man hours. Write today for complete details.

SLUDGE WEARY TRAP

APEX ALL-WEATHER PRODUCTS CO.
1525 EAST 53rd STREET
CHICAGO (15), ILLINOIS

TRAP RID OF SLUDGE



HYDRON

HYDRON Metal Bellows

Metallic Bellows

We manufacture bellows and bellows assemblies ready for installation in steam traps, relief valves, temperature regulators, pressure regulators, air valves, and other automatic temperature and pressure controls. Complete engineering service.

CLIFFORD MANUFACTURING CO.

CHICAGO
221 N. LaSalle Street

465 East First Street
BOSTON, MASS.

DETROIT
1847 W. Bethune Ave.

We Need

Postwar Engineers

Now!

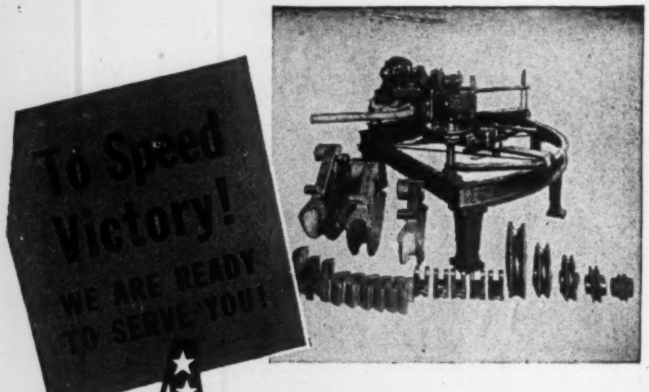
This company, while continuing its extensive war program unabated, is expanding its Engineering Department in accordance with a substantial postwar product development program. Trained men, by virtue of education and/or experience, are needed in the Test, Methods and Development Engineering Divisions. Special emphasis is placed on the need for experienced men with a flair for design and development work in the fields of electronic and mechanical engineering, particularly in conjunction with automatic control equipment. Previous experience with heating, ventilating, air conditioning and refrigeration installations is desirable, but not necessary.

Engineers, with an eye to the future and who are not now engaged in essential industry, should apply by mail enclosing photo or recent snap-shot if possible.

Applicants should give complete educational background, age, family status, experience, names of companies for whom worked and salary received in each position. Give complete information concerning draft status and present work.

If application appears to fill requirements, arrangements will be made for personal interview. Write Executive Engineer.

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Minneapolis, Minnesota



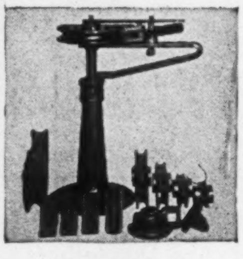
"American"

COLD PIPE, CONDUIT and TUBE BENDING MACHINES

Twelve types to select from. Hand operated capacities ¼ to 6" inclusive. Motor operated ¾ to 8" inclusive.

A few of our More Than 12,000 Customers: Kaiser Shipbuilding Co.; Bethlehem-Highham Shipyards; Portsmouth Navy Yard; Moore Drydock Co.; Stone & Webster Engineering Corp.; E. I. Du Pont de Nemours & Co.; West Penn Power Co.; Illinois Central Railroad; Federal Pipe & Supply Co.; Alabama Drydock Co.; Westinghouse Elec. & Mfg. Co.; Todd-Bath Shipbuilding Co.

Write Air Mail for printed matter.



"American"
PIPE BENDING MACHINE
Company INC

Quick Deliveries

51 PEARL ST.
BOSTON, MASS.

• MEETINGS & CONVENTIONS •

Industrial Hygiene Foundation

Industrial Hygiene Foundation, eighth annual meeting, November 10-11, Mellon Institute, Pittsburgh, Pa. "Practical, workable measures for the health maintenance of men and plants" will comprise the program. Managing director of the IHF is John F. McMahon, 4400 Fifth Ave., Pittsburgh, Pa.

Refrigerating Engineers

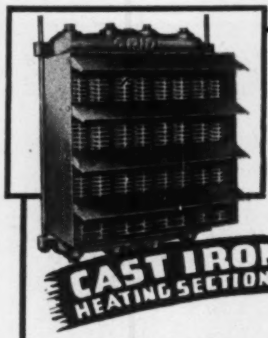
American Society of Refrigerating Engineers, 39th annual meeting, December 7-9, Benjamin Franklin Hotel, Philadelphia, Pa. Program includes papers by R. E. Cherne, Carrier Corp., on costs of operation of refrigeration for air conditioning systems; by F. H. Munkelt, W. B. Connor Engrg. Corp., on air purification and recovery with activated carbon; by F. W. Hutchinson, University of California, on refrigerating design problems in marine installations; by J. W. Craig, Crosley Corp., on "Freon 22" and its application to low temperature refrigeration units; by J. R. Vernon, Johnson Service Co., on refrigeration controls; and by Douglas B. Kendrick, Lt.-Col., U. S. Army, on refrigeration applications for blood plasma. There is also to be a forum on December 9 at the Franklin Institute on future demands for refrigeration and air conditioning, new equipment to meet those demands, and sales and distribution methods of the future. Headquarters office of the ASRE is at 50 W. 40th St., New York, N. Y.

Warm Air Heating

National Warm Air Heating and Air Conditioning Association, 30th annual convention, December 8-9, Netherland Plaza Hotel, Cincinnati, Ohio. A feature of the convention will be a program arranged by the association's postwar information committee, the chairman of which is W. L. McGrath. Paul B. Zimmerman will report on the Indoor Climate Institute, H. F. Randolph will present a paper on radiant heating, and A. P. Kratz and S. Konzo will discuss research. Managing director of the NWAHACA is George Boeddener, 145 Public Square, Cleveland, Ohio.

Heating and Ventilating Engineers

American Society of Heating and Ventilating Engineers, 50th annual meeting, January 31-February 2, Hotel Pennsylvania, New York City. A special program dealing with the past, present, and future is being planned. See ASHVE Journal Section in this issue for further information. Secretary, A. V. Hutchinson, 51 Madison Ave., New York 1 N. Y.



D. J. MURRAY MFG. CO.
WAUSAU, WISCONSIN

a UNIT HEATER

THAT WILL LAST LONGER THAN OTHER TYPES OF HEATING EQUIPMENT—

DESIGNED and tested to operate with either steam or hot water—up to 250 lbs. steam pressure. Lower outlet temperatures . . . greater air volume . . . more air changes per hour . . . no electrolysis to cause corrosion. Each "fin" heating section cast in one piece of high test cast iron . . . no heating failures . . . no leaks . . . no breakdowns . . . no maintenance expense. Made in 9 sizes—Patent applied for. *Territory open for high grade distributors*

GRID UNIT HEATER

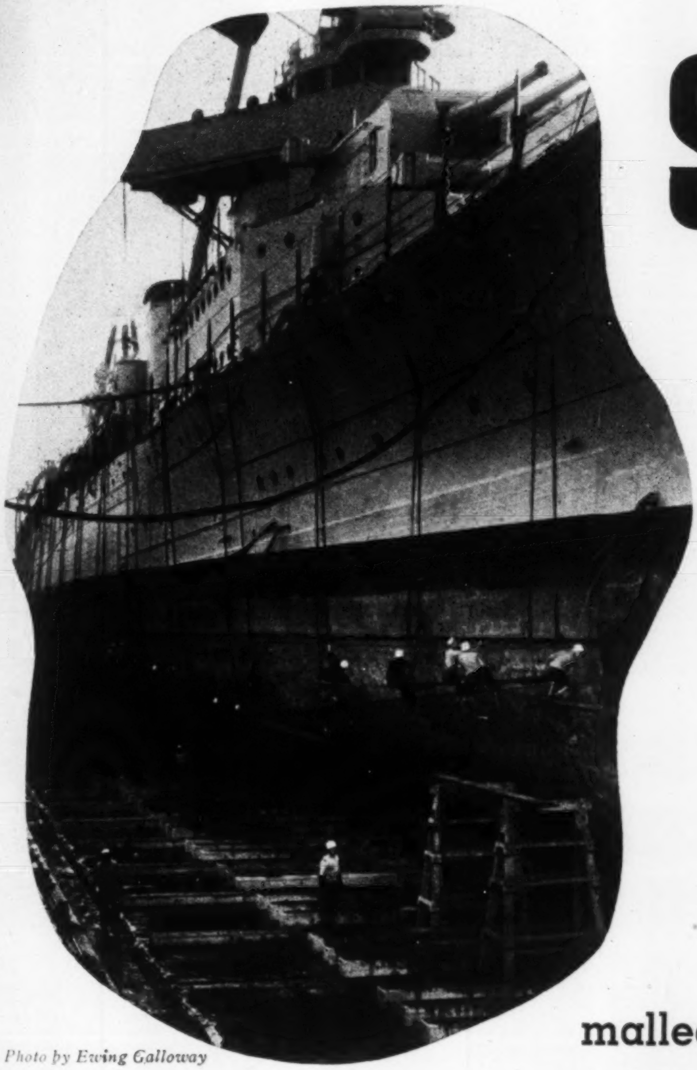


Photo by Ewing Galloway

SHIPS!

MIGHTY BATTLESHIPS . . . FAST DESTROYERS . . . SUBMARINES . . . TROOPSHIPS and FREIGHTERS all require malleable iron fittings. "M I F" malleable iron fittings are all made from air refined malleable thus assuring added safety to their important piping systems. The best is none too good for this all important service.

MIF

Trade Mark

SERVICE FOR FREEDOM

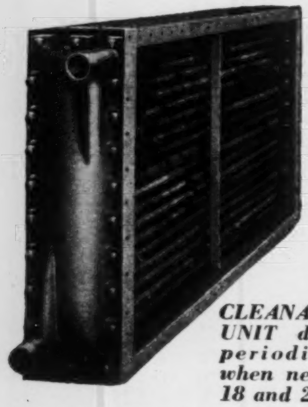
MALLEABLE IRON PIPE FITTINGS
BRANFORD BRASS SEAT UNIONS

MALLEABLE IRON FITTINGS CO., BRANFORD, CONN.

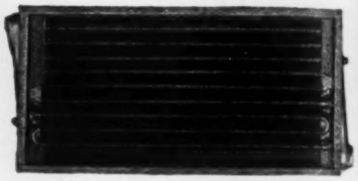
POST WAR PLANNING DEMANDS

AEROFIN

Heat-Exchange Surface



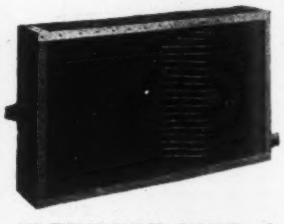
CLEANABLE TUBE UNIT designed for periodic cleaning when necessary. 12, 18 and 24 tube face.



UNIVERSAL UNIT, 1-Row and 2-Row Units. "S" bend construction—headers on opposite ends.

CENTRIFUGAL HEADER UNIT, showing 2 inlet and 2 outlet headers for a 37-7/16 inch Unit.

BOOSTER UNIT designed for either vertical or horizontal air-flow and for working Steam-Pressures up to 200 lbs. gauge.



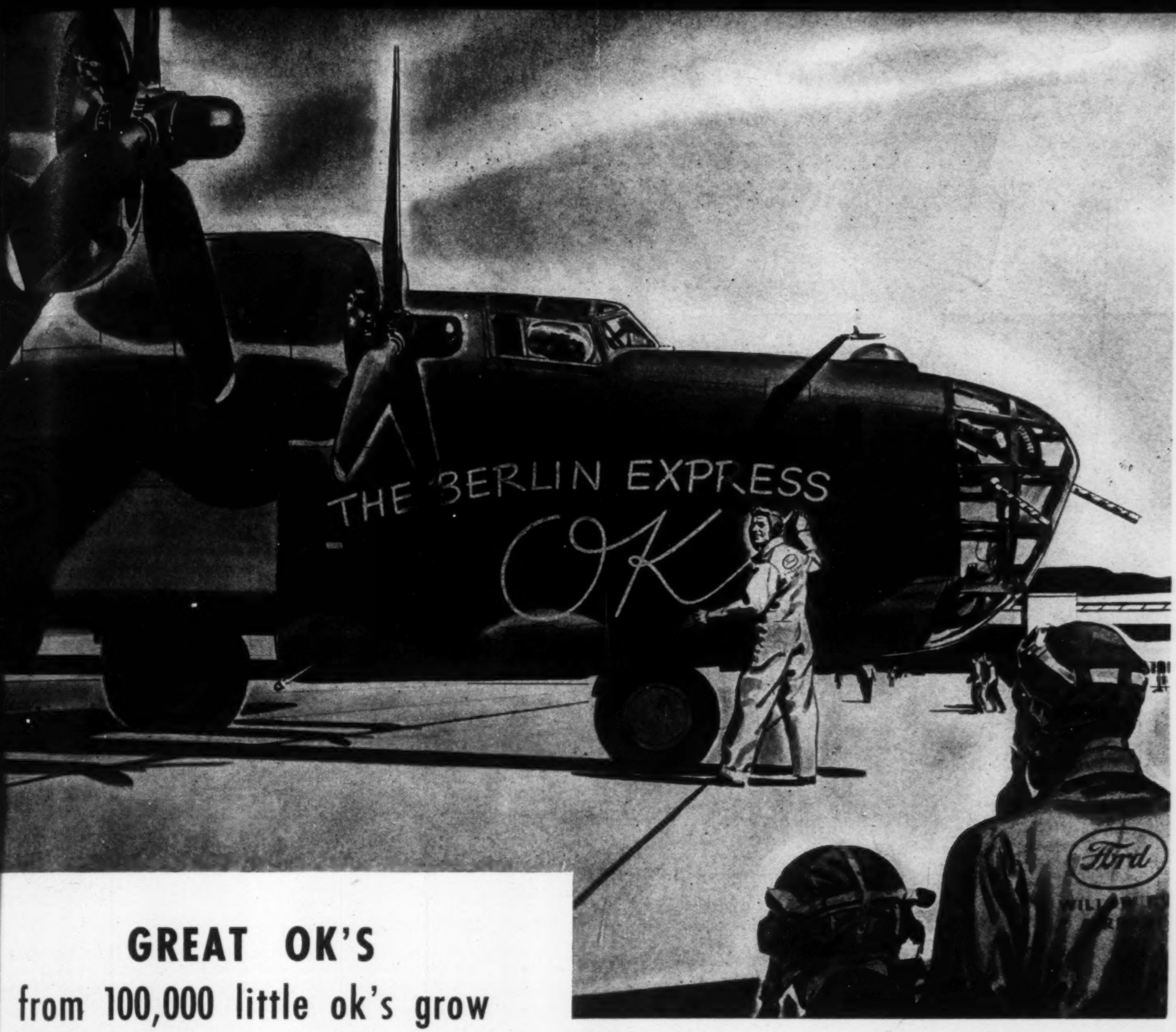
FLEXITUBE UNIT, designed for either vertical, horizontal or flat position. 12 and 18 tube face.

Write for complete technical literature on your specific problem.

AEROFIN CORPORATION

410 S. GEDDES ST., SYRACUSE, N. Y.

Chicago Detroit New York Philadelphia
Dallas Cleveland Toronto



GREAT OK'S

from 100,000 little ok's grow

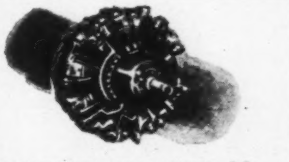
Flight test OK—the final of 100,000 ok's required on every B-24 Consolidated Liberator bomber built at the great Ford Willow Run plant. Precision parts in these bombers must be held to tolerances as close as one twenty-thousandth of an inch. Gages for inspecting these parts are checked against master gages in air-conditioned rooms to prevent variations due to temperature changes and corrosion from excess humidity. This is just one of the 17 applications of Westinghouse Air Conditioning and Industrial Refrigeration in six Ford plants.

After Victory, Westinghouse "Conditioning" will bring a "thousand" new-day benefits. Better products at lower cost, greater year 'round comfort—better living for all.

In meeting varied "conditioning" problems, Westinghouse draws upon years of experience. The exclusive hermetically-sealed compressor assures economy, dependability, long life. Inquiries are invited from producers of war materials and from postwar planners. Westinghouse Electric & Manufacturing Company, 711 Page Blvd., Springfield, Mass.

BULL'S-EYE IN THE SKY. Antiaircraft gunfire directors are gaged and assembled at temperature and humidity held constant by air conditioning for perfect fit of parts.

WORLD'S TOUGHEST "FLIVVERS". In annealing body steel for Ford-built "blitz-buggies", process air must be dehumidified. This is done with air conditioning.



MORE POWER PER POUND. Magnesium, used for lightness and strength in Ford-built aircraft engines, is laboratory tested under controlled air conditions for accuracy of testing instruments.

AILERON AND RUDDER FABRIC is sprayed with a "dope" compound for strength. Correct temperature and humidity, provided by air conditioning, assure proper drying and protect against explosions.

Tune in John Charles Thomas, Westinghouse Program, NBC, Sunday, at 2:30 P.M., E.W.T.

Westinghouse *Air Conditioning*

GEARED TO A THOUSAND WARTIME NEEDS

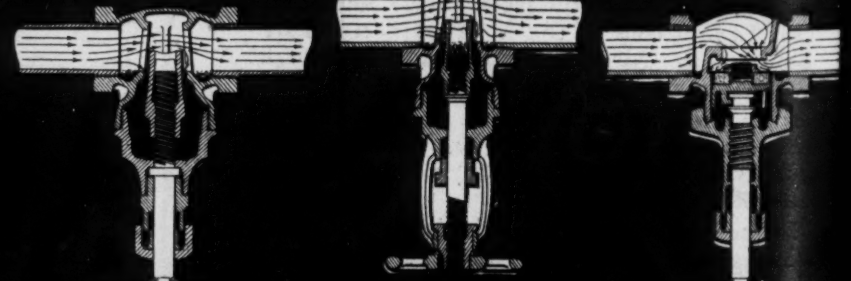
Prevent Valve Failure *before it starts!*

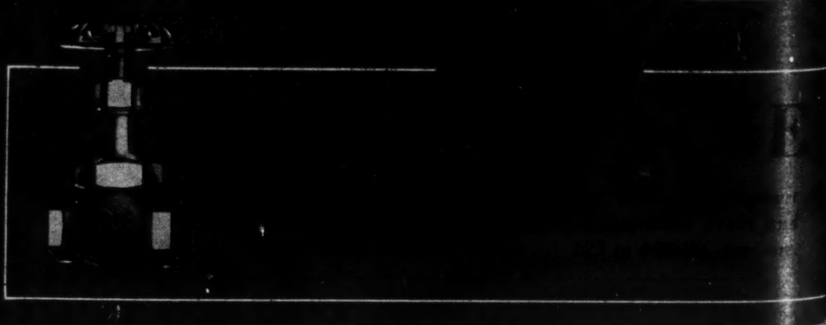
SEDIMENT SMOTHERS WORKING PARTS...

speeds destructive wear in "Upside Down Valves"

[illegible]

WHY INVERTED INSTALLATION STARTS VALVE "HEADACHES"





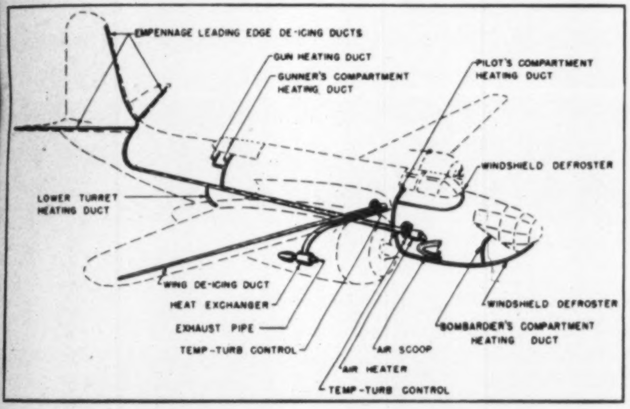
EQUIPMENT DEVELOPMENTS

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1943 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk equipment and manufacturer not listed.

Turbine for Temperature Control

No. 2527—A novel method of temperature control announced last month is known as the "temp-turb"; it is an air operated, thermal sensitive device for providing a directed torque or rotation which depends upon the temperature of the air that operates it. It can be used to control the temperature of ducted air for many applications. A typical installation for controlling the temperature of the air entering an airplane heating system is shown in the accompanying diagram.

The temp-turb is energized by the flowing air, and operates as a simple impulse turbine. However, the turbine blades, being bimetal, are not rigid, and reverse their direction of curvature as their temperature goes above or below a fixed control point. At this temperature (the control point of the unit) the blades are straight and, therefore, no torque or rotation is produced.


EMPENNAGE LEADING EDGE DE-ICING DUCTS
GUN HEATING DUCT
GUNNER'S COMPARTMENT HEATING DUCT
PILOT'S COMPARTMENT HEATING DUCT
WINDSHIELD DEFROSTER
LOWER TURRET HEATING DUCT
WING DE-ICING DUCT
HEAT EXCHANGER
EXHAUST PIPE
TEMP-TURB CONTROL
WINDSHIELD DEFROSTER
BOMBARDIER'S COMPARTMENT HEATING DUCT
AIR SCOOP
AIR HEATER
TEMP-TURB CONTROL

Schematic diagram of temp-turb installation

Various components of the control unit are shown here

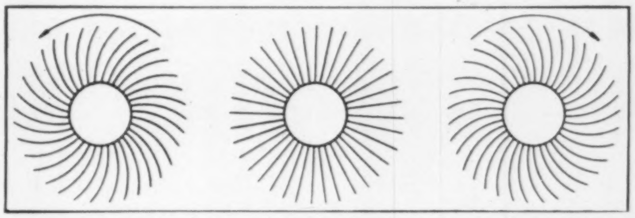
When used in connection with the manufacturer's shutter ring assembly, the temp-turb closes the shutters when the temperature goes below the control point. The shutters are closed sufficiently to restrict the flow of air through the heater to such an amount that the air is discharged from the heater at the control point temperature. If the temperature of the air is above the control point, the device operates in the opposite direction, the shutters open, and the flow of air is increased. The temp-turb is designed to operate under any weather conditions and in ambient temperatures ranging from —70 F to 300 F.

The unit can be mounted in any position, but it is preferable to install it in such a manner that any material that might get into it will drain down into the duct. If possible, it should be mounted above the center line of the duct close to the heater so that it will respond quickly to temperature change.

It has been demonstrated that the temp-turb will hold duct temperatures within plus or minus 5 F if the source of heat is close to the control assembly. Under all tests, the operating differential has been found to be within a range of plus or minus 15 F.

Heat storage in the system upstream from the temp-turb will reduce sensitivity of control; hence the desirability of keeping the source of heat close to the control unit.

The temp-turb control has inherent falling characteristics on the pressure vs. torque basis. Greatly increased pressures do not result in greatly increased torque, because the turbine blades, being thin strips, are subject to "blow back" as the pressure rises. This condition results in a safety feature for gears and other mechanisms that are driven by the temp-turb, inasmuch as unusually large pressures will not result in forces sufficient to destroy the mechanism.



Left to right—Exaggerated curvature of turbine blades with temperature below control point. . . . At control point, blades are straight and there is no rotation. . . . Exaggerated curvature of turbine blades with temperature above control point

Vibration conditions as encountered in aircraft practice will not affect the operation of the temp-turb units. The turbine blades do vibrate, but their endurance limit is many times higher than that permitted by standard aircraft vibration tests, and the average torque from a vibrating blade is the same as that produced by a still blade.—General Electric Co., Aviation Div., Schenectady, N. Y.

Heating, Piping & Air Conditioning, [12-43]
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature.

(Circle each number in which you are interested)

2527 2528 2529 2530 2531 2532 2533 2534 2535
4583 4584 4585 4586 4587 4588 4589 4590 4591 4592
4593 4594 4595 4596 4597 4598 4599

Name.................................. Title.............
Company ....
Address ....
City.................................. State.............

The DIRECTORY NUMBER for 1944

Coming Next Month!

- Once again, the January issue of Heating, Piping & Air Conditioning will be the big Annual Directory Number for 1944 . . . an annual issue which has become an outstanding institution of service in the field.

Each year for 10 years the editors of Heating, Piping & Air Conditioning have planned the January issue so that it contains a wealth of information to be used by readers throughout the entire year.

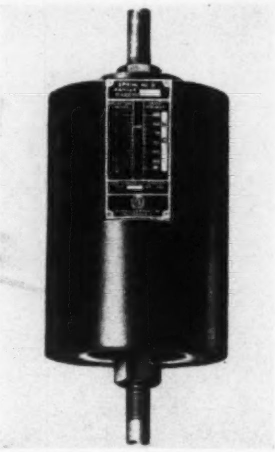
In January, 1944, the Directory Number will intensify its attention to the current and future problems of readers.

Bigger and better than ever, the January number will be another in the long list of this publication's war time services to its readers and to the manufacturers who serve them.

[illegible]

Spring Hangers for Piping

No. 2528—New pre-engineered spring hangers for piping are available in 14 sizes with a load range from 84 to 4700 lb. Each size permits a uniform variation in supporting force of not more than 12½ per cent in ½ in. deflection of the spring, according to the manufacturer. Careful study was given the design to minimize the change in supporting force of the hanger during change in the vertical axis of the piping.

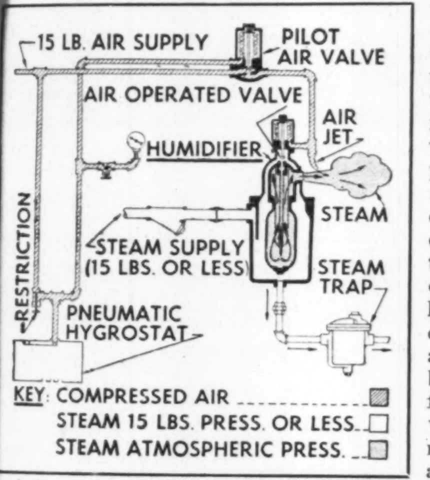


Erection is simplified through incorporation of a scale plate on the side of each hanger to insure correct installation of the equipment.

These hangers have been designed to meet the requirements of the American Standard Code for Pressure Piping (ASA B31.1-1942), section 6, fabrication details. Advantages summarized by the manufacturer obtained through the use of these hangers include minimum change in pipe supporting force, easy adjustment and elimination of turnbuckle because of unique swivel coupling, the compact and neat appearance, minimum headroom requirement, and ease of selection from a simple capacity table. —Grinnell Co., Inc., 260 W. Exchange, Providence, R. I.

Compressed Air Operated Humidifier

No. 2529—Originally developed for process industries where the moisture content of materials is of importance in handling and manufacture, steam type unit humidification has been found highly valuable also in preventing fires and explosions caused by static electricity, says the manufacturer of a special unit humidifier operated by compressed air which has been developed for use in places where there are mixtures of air and gas, or air nd dust, or where explosive materials are in process.



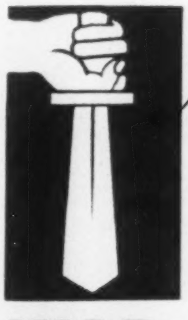
As shown by the diagram, this humidifier uses compressed ir in connection with a humidistat to control the steam alve on the humidifier when required, and to disseminate he exhaust steam into the atmosphere by air blast. With his arrangement there is no sparking hazard.

The cost of humidification with this type of equipment is aid to be low, amounting to less than two cents an hour for 0,000 sq ft of area.—Armstrong Machine Works, 874 Maple t., Three Rivers, Mich.

lectronic Flame Guard for Gas Burners

No. 2530—Most outstanding of the improvements incorporated over a period of years in the manufacturer's fan-ir mechanical draft automatic gas burner is the recently atented "Transaxil" flame guard safety pilot; it represents an epochal change in flame failure equipment," says its aker.

It embodies the electronic principle of operation, combined ith a unique pilot that is unaffected by high furnace temperatures thus eliminating the use of metallic electrodes and



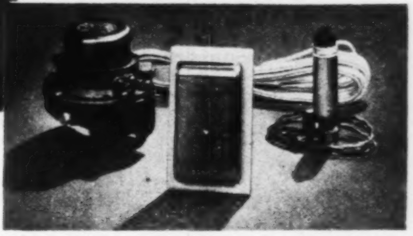
Mobilization for WAR and PEACE

One of the outstanding features of the mobilization of industry for war production is the interchange of ideas and information among manufacturers. The pooling of vital information, unlocking the door to heretofore closely guarded "trade secrets," will help immeasurably to hasten the day of Victory. It will also contribute liberally to the improvement in construction and design of post-war products.

While concentrating on our job of turning out automatic controls for the engines of modern warfare, we are using specialized skills gained in working with new materials, new methods of fabrication. When the time comes, this knowledge will be used to help raise the already high American standards of living and production efficiency to even greater heights.

PACKAGE SETS

B-60



Write for Catalog 52

Everything you need—*wrapped up in a package*—for quiet, safe, automatic control of central and floor furnaces, gas-fired boilers, radiators, gas ranges and water heaters. Handling manufactured, mixed, natural or butane gas, the B-60 gas valve with tamper-proof cover and integral pilot valve assembly; an ivory-and-chrome finished Trimtherm thermostat; 30 feet of wire; and a thermocouple pilot generator providing all current needed for efficient valve operation. Regular, thermometer and timer-thermostats available with or without night cut-off.

GENERAL CONTROLS

[illegible]

[illegible] AVENUE GLENDALE [illegible] CALIFORNIA

[illegible]

R-S
Valve Engineering Service
is NATION-WIDE

In strategically located cities from Boston to Dallas, and from New York to San Francisco, there are thoroughly experienced R-S Valve engineers who are eager to assist in the simplification of valve installations, willing to recommend the type of equipment best adapted to a particular control or shut-off condition and cooperative in pointing out possible changes in present equipment that will effect greater efficiency and economy.

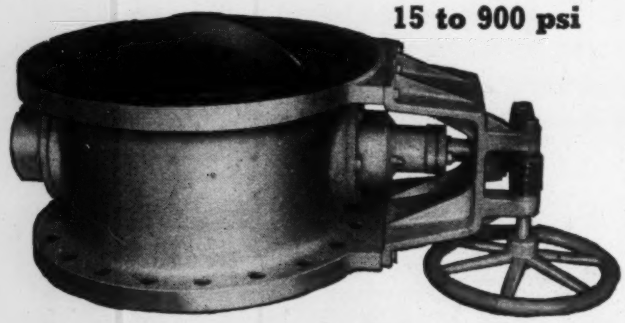
Carefully selected for their engineering ability and experience in the installation and operation of valves, these men have been especially trained in the selection of alternate metals for resistance against heat, abrasion and corrosion as well as the application of R-S Valves under high or low pressures and temperatures whether the medium to be controlled is air, gas, steam, liquids or semi-solids.

The R-S representative is at your beck and call. Telephone the one nearest you for prompt service.

No. 502 20-inch, 125 pound American Standard Valve, hand wheel control, ball bearing mounted with stuffing box.

●

15 to 900 psi



Atlanta, Ga.
C. E. JOHNSON & ASSOCIATE
Bona Allen Bldg., Walnut 4571

Baltimore, Md.
KONE ENGINEERING CO., 11 W. 25th St., Belmont 0138

Boston, Mass.
W. B. PARSONS CO., 10 High St., HUBrd 4119

Buffalo, N. Y.
R. W. CRANE, 37 Parkwood, Kenmore, N. Y., DELawr 8141

Charlotte, N. C.
LYDON-COUSART COMPANY
304 Builders Bldg., Phone 3-4481

Chicago, Ill.
W. P. NEVINS CO., 53 W. Jackson Blvd., Harrison 1473

Cincinnati, Ohio
H. T. PORTER CO., 1413 Union Central Bldg., Main 1299

Cleveland, Ohio
ASHMEAD-DANKS CO., Rockefeller Bldg., Main 6192

Des Moines, Iowa
PRODUCTS, INC., 1006 Liberty Bldg., 4-0777

Detroit, Mich.
SPURGEON COMPANY, 5050 Joy Road, Tyler 7-2750

Houston, Texas
POWER SPECIALTY COMPANY
1042 Mellie Esperson Bldg., Preston 5384

Indianapolis, Ind.
POWER PLANT EFFICIENCY CO.
Union Title Bldg., Market 4617

Los Angeles, Calif.
BUSHNELL CONTROLS & EQUIPMENT CO.
117 W. 9th St., Vandike 1359

Milwaukee, Wis.
KRENZ & COMPANY, 5114 W. Center St., Hilltop 2983

Minneapolis, Minn.
GEO. R. MELLEMA, 4234 Grimes Ave. So., Walnut 6984

New Orleans, La.
JOHN H. CARTER CO., 1013 Canal Bldg., Magnolia 1847

New York City
F. H. YOCUM-A. H. GOODE
Graybar Bldg., Murray Hill 5-3370

Philadelphia, Pa.
SHEFFLER-GROSS CO., Drexel Bldg., Lombard 4900

Pittsburgh, Pa.
J. F. HALLOWELL, Columbia Bldg., Court 5362

Rochester, N. Y.
GEO. VAN VECHTEN, 217 East Avenue, Stone 4164

St. Louis, Mo.
RUSSELL PATTON, 3020 Olive St., Franklin 2836

San Francisco, Calif.
BUSHNELL CONTROLS & EQUIPMENT CO.
Mills Tower, 220 Bush St., Exbrook 1102

Seattle, Wash.
M. N. MUSGRAVE & CO., 2019 Third Ave., Eliot 4425

Tulsa, Okla.
DOUGLAS FRAZIER, 1524 So. Gary Place, 6-0384

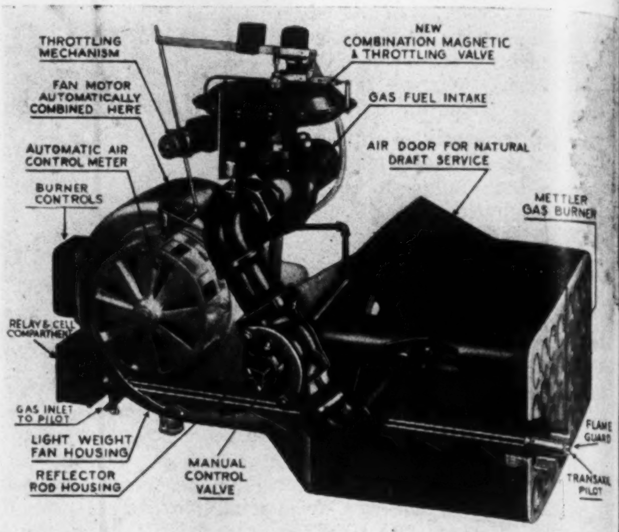
Washington, D. C.
A. BURKS SUMMERS
411 Colorado Bldg., 14th & "G" Sts., N.W., Republic 7231

VALVE DIVISION
R-S PRODUCTS CORPORATION
132 Berkley Street • Philadelphia 44, Pa.

R-S *Streamlined*
BUTTERFLY VALVES

light focusing arrangements. The light reflection from a pilot or main burner flame is conveyed to a photo-electric multiplier tube through "Vitriosil" (pure fused quartz) which is non-combustible and therefor capable of withstanding temperatures exceeding 2800 F.

The success of the design is chiefly due to submerging the "Vitriosil" reflector rod directly into the flame to be protected, thus having actual contact between the light source and electronic controls. The light is conveyed direct to the voltage multiplier photocell which is located at a remote point and also unaffected by high temperatures. The light energy is amplified sufficiently to operate relays.

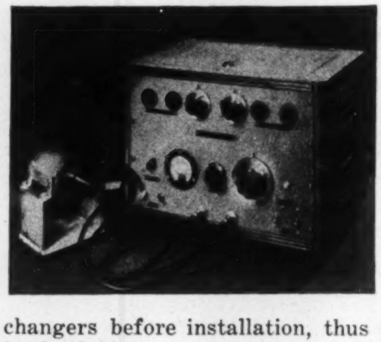


According to the manufacturer, this system of combustion control—which is adaptable to all gaseous fuels—avoids the nuisance and annoyance of interruptions in service due to groundout, moisture, oxidation of metallic connectors, etc. It is unaffected by high temperatures or temperature changes, wall radiation or surrounding light reflection, or moderate line voltage fluctuations.

Prevailing conditions limit the sale of this flame guard safety pilot to factory assembled equipment such as in the fan-air burner. This burner is available in sizes suitable for boilers from 5 to 300 hp.—Lee B. Mettler Co., 406 S. Main St., Los Angeles 13, Calif.

Electronic Flaw Detector for Tubing

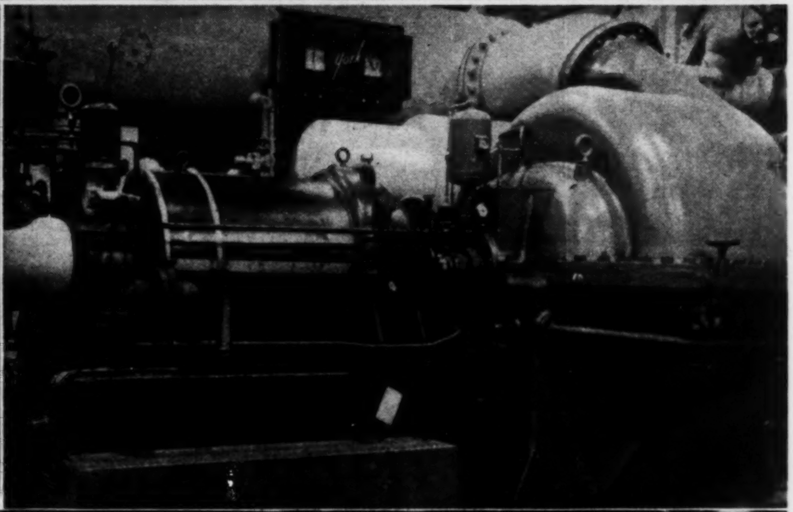
No. 2531—A new, high-frequency, electronic flaw detector for production line detection of longitudinal cracks and seams in nonmagnetic metallic tubing in an extensive range of diameters and wall thicknesses is capable of detecting and locating imperfections ½ in. long, 10 mils wide, and one-third of the wall thickness in depth, even though they are on the inside of the tubing and do not appear on either surface, says the manufacturer. It is especially desirable for testing tubing for coolers and heat exchangers before installation, thus preventing flaw failures in the field.

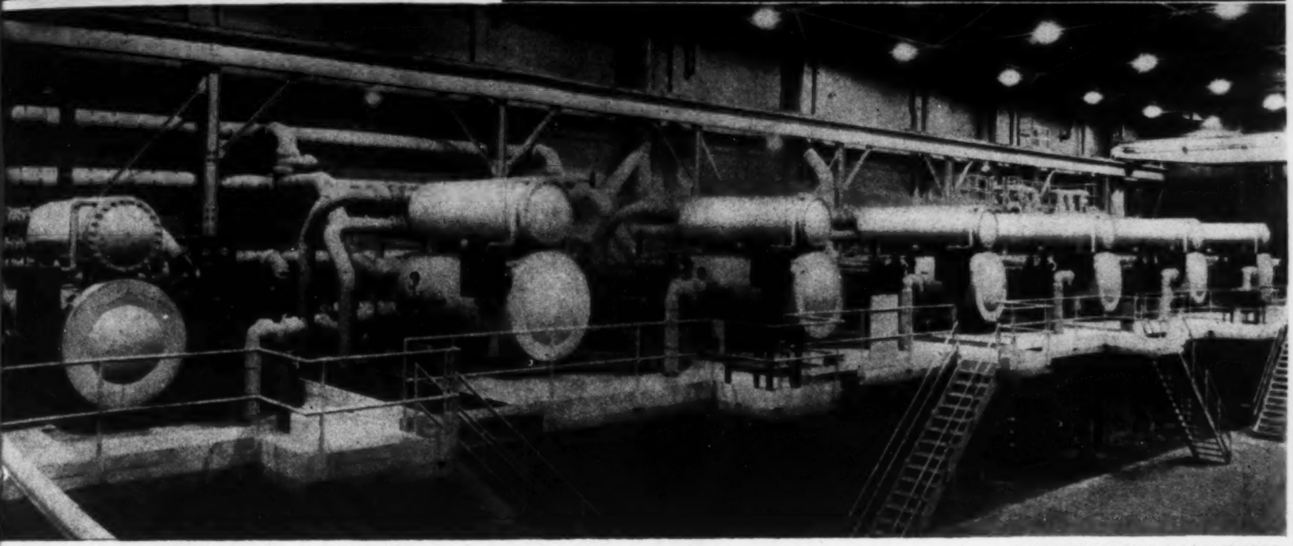


In the operation of the instrument the tubing to be tested is fed through a coil box whose coils are arranged in such a way that they surround the tubing. After the circuit constants for the particular size of tubing being tested are set by means of selector switches on the panel of a control unit, power is applied to the coils which in turn induce eddy currents in the tubing. A flaw in the tubing causes changes in these eddy currents. An electronic circuit in the control

[illegible] REFRIGERATION

Cools 21 Acre Bomber Plant





COURTESY DOUGLAS AIRCRAFT CORP.

AIR CONDITIONING, vital to any blackout plant, maintains even temperature and humidity day and night, summer and winter in this mile-long bomber hatchery. Seven steam-driven York Allis-Chalmers turbo compressor water cooling systems chill 14,000 gallons of water per minute . . . providing an efficient climate for top speed production of these vital weapons. Whether your mechanical cooling problem involves vast areas, a department, a single room, process or machine, a huge strato-chamber or a small test cabinet, York engineering experience will have anticipated your need. Throughout industry today, York air conditioning is cutting rejects and permitting close tolerance manufacturing through accurate control of temperature and humidity. York Corporation, York, Pennsylvania.

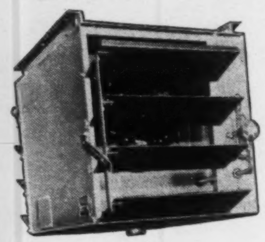
york
refrigeration
air conditioning

YORK REFRIGERATION AND AIR CONDITIONING FOR WAR

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

KRAMER
LOW TEMPERATURE
Unit Coolers

FREEZING OVEN
Electrical Defrost

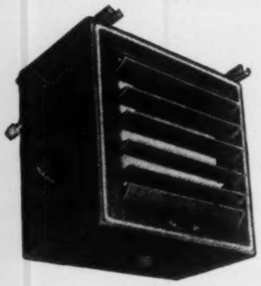


for LOW TEMPERATURES (below 32°)

THE FREEZING OVEN is a low temperature unit cooler with a self-contained electrical defrost mechanism. The complete unit is housed in an insulated shell with insulated front and rear adjustable louvers.

SPECIFICATIONS: All copper KRAMER coil, ⅝" tube, ½" fin spacing, fin sweated to tube. An electrical heater of suitable wattage, suction line hand valve mounted on shell shunted by a relief valve. Insulated steel housing, insulated adjustable front and rear louvers, specially designed silent fan driven by totally enclosed fan duty motor of proper capacity designed for continuous operation.

FREEZING SHOWER
Water Defrost



MATE TO THE FREEZING OVEN

THE KRAMER FREEZING SHOWER offers a low temperature unit using a water shower of ordinary tap water to defrost. It can be completely defrosted in a few minutes without effecting the temperature of the box, simple to install and operate.

Send for descriptive Folders on the KRAMER FREEZING OVEN and the KRAMER FREEZING SHOWER.

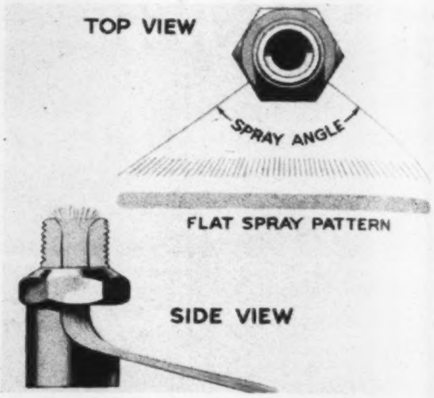
KRAMER TRENTON CO.
Trenton, New Jersey

unit detects these changes and energizes a signal relay, thus disclosing to the operator the existence and location of the flaw.

The detector consists of a control unit, which is standard for testing various sizes of nonmagnetic tubing, and a coil box which accommodates any one specific size of round, straight tubing of uniform outside diameter from ¼ to 2 in., inclusive. Additional coil boxes, fully interchangeable as to mounting, dimensions, and cable terminals, are available to accommodate any size tubing within the dimensions specified.—General Electric Co., Schenectady, N. Y.

New Type Flooding Nozzle

No. 2532—Wherever an exceptionally wide flat spray is required, a new flooding nozzle recently developed will prove extremely useful, according to its maker. Designed for use in spraying eliminator plates and similar applications, the flooding nozzle is available in brass and other standard materials.



Surfaces of the nozzle making contact with the liquid sprayed are finely finished. Curved areas have been designed to produce the desired spray in the most efficient manner.—Spraying Systems Co., 4031 W. Lake St., Chicago, Ill.

Flaring Tool for Plastic Tubing

No. 2533—A new flaring tool designed specifically for use with plastic tubing and which produces the approved type double thickness flare for connecting this tubing with flare fittings, has been announced. One tool handles the four most popular sizes of tubing: ⅜, ½, ⅝, and ¾ in. outside diameter. While the tool is designed especially for 0.062 in. wall tubing, it will also handle 0.031 in. wall.

The flare produced by this tool is called a "double flare" because the plastic tubing is folded back at the ends to form a flare with double thick, double strength walls, says the maker.

The complete tool consists of flaring bar, yoke with swivel cone and four adapters, all furnished in a metal kit.—Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7, Ill.

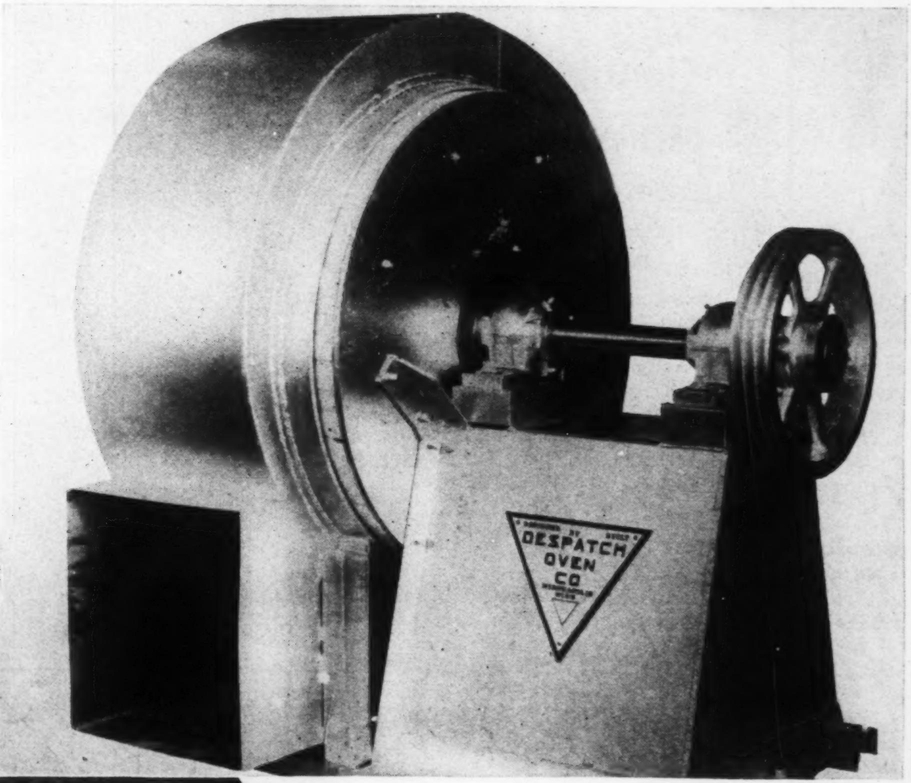
Universal Centrifugal Clutch

No. 2534**—A new type of automatically engaging and self-disengaging centrifugal clutch can be produced in an unlimited range of sizes and capacities, can serve either as a coupling between shafts or as a driving pulley or gear in a transmission, as well as a starting cushion between power units and driven mechanisms.

This unit, known as the "Torkontrol," consists of a partially filled oil chamber fitted with a freely rotating hub which carries a series of movable wedge shaped flyweights. As the hub revolves these weights fly outwardly and engage

HOW *Bearings take it*

ON DESPATCH FANS

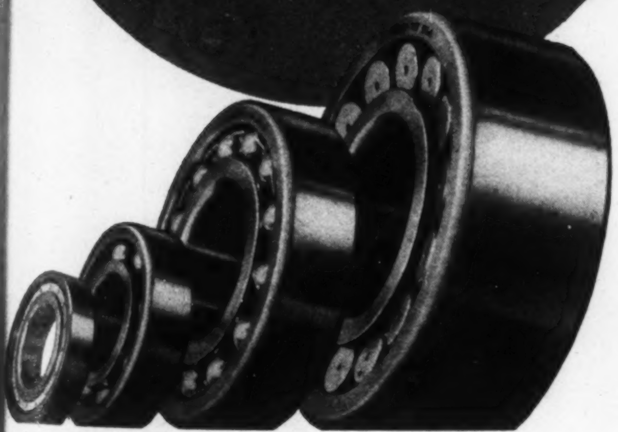


• *Built by*
DESPATCH OVEN CO.

SKF

Ball and Roller

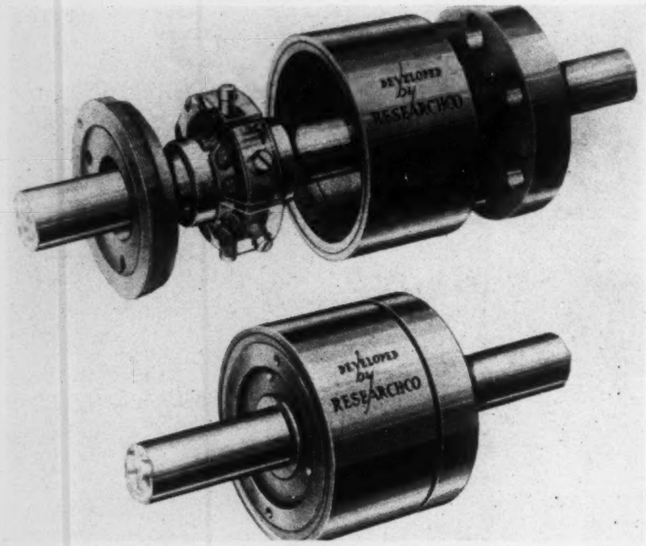
BEARINGS



The search for bearings that could take it on this all-welded acid resistant fan ended with SKF Bearings and Pillow Blocks. No matter whether this fan handles cold air when the furnace starts operation or accommodates the sudden and intense blast which follows from the heater, SKF's are always *there* with performance. Easily installed, inspected and lubricated, SKF Pillow Blocks enable SKF Bearings to give satisfactory performance. As a result, the bearings through built-in alignment maintain their full load carrying capacity while permitting shaft deflections and slight mounting inaccuracies. A machine that's SKF-equipped is a machine that's "all-out" in the war production program.

5420

SKF INDUSTRIES, INC., PHILA., PA.



the internal rims of the outer case binding the hub and shell into a functionally solid pulley or coupling.

The manufacturer claims that this unit permits the use of smaller engines or motors which start without load, give smooth cushioned application of power, straight line acceleration with resulting saving in operating cost.

These clutches have been built in all sizes from ¼ to 500 hp, for both builtin and general application.—Amalgamated Engineering & Research Corp., 100 W. Monroe St., Chicago 3, Ill.

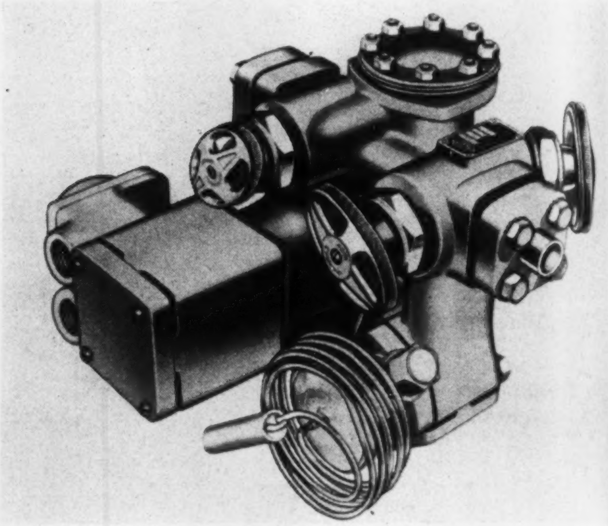
Manifold Eliminates 20 Joints

No. 2535—A new assembly known as Navy type "Q" control valve manifold is primarily intended for automatic refrigerant control aboard ship but is adaptable to many refrigeration installations.

Worked out in cooperation with the Navy Department and the Henry Valve Co., this manifold is designed to replace builtup bypass assemblies, thereby eliminating 20 joints.

This elimination of numerous joints is vital on shipboard because of engine vibration, racking and straining, gun firing, and shell explosions. However, many other installations would be practicable and economical, particularly where the factor of vibration is present.

Also, since space on ships is at a premium, the manifold combines into one compact assembly a solenoid valve, thermostatic expansion valve, strainer, shutoff valves, hand expansion valve, flanged line connections, and a mounting bracket. Standard Navy type thermovalve power assemblies and cages are used in the unit. It is made in a wide range of capacities, voltages, and line connections.—Alco Valve Co., 2628 Big Bend Blvd., St. Louis, Mo.



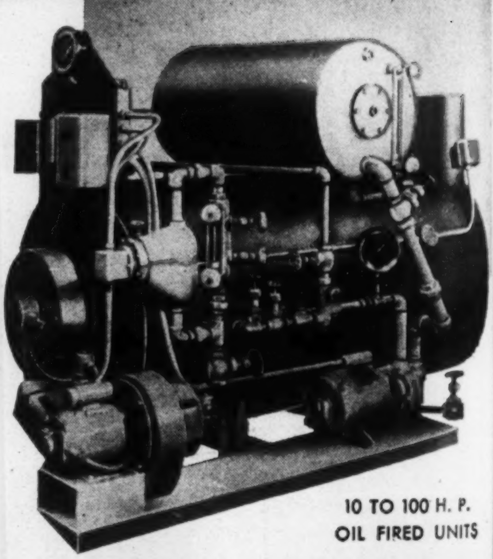
Something New in Steam Generators

THE O&S Powermaster UNIT

WITH SPEEDIER STEAMING CAPACITY

Designed for fast, efficient steam production, the new fully-automatic "Powermaster" is a complete, "packaged" unit. Compact. Lightweight. Easy to install. Easy to clean. And exceptionally speedy — developing 100 lbs. pressure from 60° water in 18 minutes or less!

Backed by more than a half-century of engineering skill and craftsmanship, the new "Powermaster" offers a new "high" in safety, cleanliness and low-cost fuel consumption. Such advantages—which resulted in its use by the Army, Navy and Pan American Airways — can be gained by plants with an AA-2 priority, or better. But in any case, investigate *now* its wide possibilities in your plant.



10 TO 100 H. P.
OIL FIRED UNITS

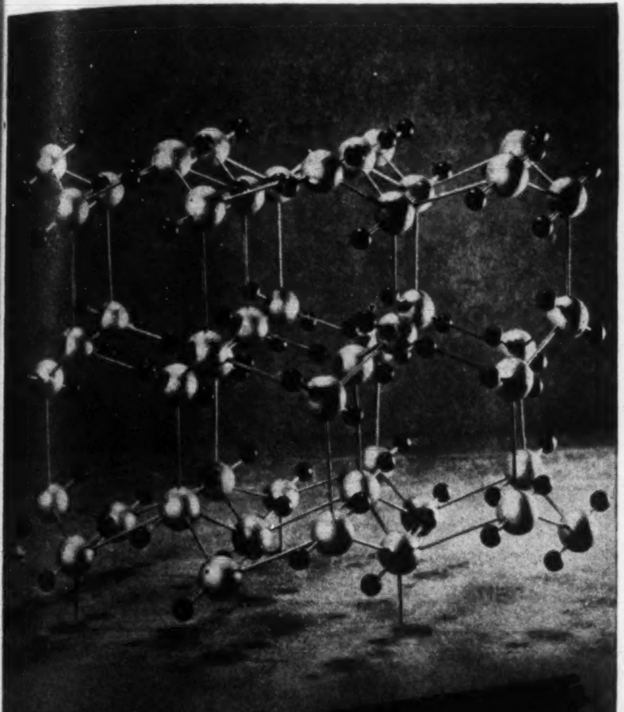
Get Powermaster Bulletin No. 1213 . . .

It gives you complete information on this new O & S Steam Generating Unit. Your copy will be promptly mailed, without obligation. Write now to ORR & SEMBOWER, INC., 942 MORGANTOWN ROAD, READING, PA.

ORR & SEMBOWER INC.
READING • PENNSYLVANIA

O&S

Builders of Better Boilers
Since 1885



INSULATION PROBLEM...

THE STRUCTURE shown above represents one of the fundamental insulation problems in refrigeration. It is, in effect, the "catalyst" in which vermin and mold breed . . . it favors the activities of termites . . . and it is the basic cause of rot. It is a physicist's representation of molecules of water . . . in crystal form, as ice. The small balls represent hydrogen atoms, the large balls oxygen atoms.

Water, or moisture, causes no insulation problems, however, when J-M Rock Cork is used for low-temperature insulation. For J-M Rock Cork is sealed against moisture . . . is immune to termites, vermin, mold. It can't rot, does not absorb odors.

Rock Cork is essentially mineral wool, one of 4 basic materials from which all Johns-Manville products stem: Asbestos, asphalt, diatomaceous earth and mineral wool.

Today, the prime task of Johns-Manville is to make these products as fast and as well as possible for war needs until Victory is won. Johns-Manville, 22 East 40th St., New York 16, N. Y.

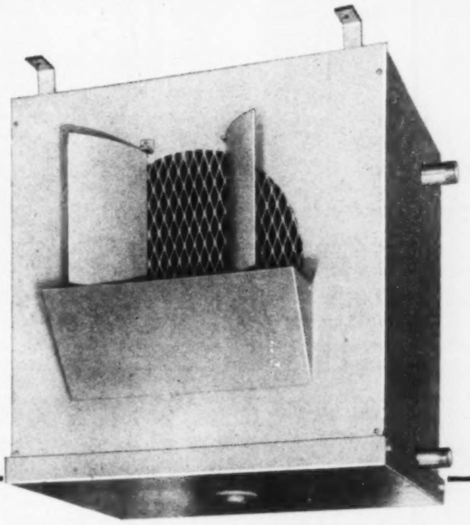
JM

Johns-Manville
ROCK CORK

KENNARD UNIT COOLERS

Series RS Unit Cooler

FOR REFRIGERATED STORAGE ROOMS



100% UTILIZATION OF COIL—*THE KENNARD WAY*

Full coil surface is utilized when air is drawn through coil. KENNARD SERIES RS UNIT COOLERS are expertly engineered for economical, enduring service. Write for prices.

ALL THESE ADVANTAGES

☆ 100% Utilization of coil surface ☆ Efficient, quiet, pressure type propeller fans ☆ Units for brine, freon, ammonia and methyl-chloride ☆ Adjustable directional louvers at no additional cost ☆ Heat exchangers furnished as standard equipment ☆ Water defrost available at slight additional cost ☆ Motors are of enclosed type (moisture and dirt-proof) ☆ Units can be furnished for low temperature application ☆ Insulated drain pan ☆ Certified capacity ☆ Durable construction.

Cooling • FINNED COILS • *Heating*

AIR CONDITIONING UNITS • REFRIGERATION UNITS

SAM KENNARD INC.

4821 Easton Ave. St Louis 13, Mo.

• RECENT TRADE LITERATURE •

For your convenience in obtaining copies of these bulletins, see coupon on page 137. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Air Conditioning and Refrigeration

No. 4583—32 p. booklet briefly presenting the vital services performed by refrigeration and air conditioning in war and in peace, their essentiality to the morale and health of civilians and fighting men, and their uses in the advancement of new industrial, nutritional, and research techniques. Many illustrations are included and the numerous applications of refrigeration and air conditioning are noted. —Air Conditioning and Refrigerating Machinery Association, Southern Bldg., Washington, D. C.

Air Exhausters

No. 4584—16 p. booklet on "B-W Air-X-Hauster," a roof ventilator made of noncritical materials and used extensively on government buildings and war plants. Construction details, installation instructions, dimensions, capacities, and performance are given in detail.—G. C. Breidert Co., 634 S. Spring St., Los Angeles 14, Calif.

Blueprints and Black and White Prints

No. 4585—Folder describing new table type continuous printers for blueprints and black and white prints for producing prints up to 44 in. wide in any lengths at a speed up to 42 in. per min.—Peck & Harvey, 4327 Addison St., Chicago, Ill.

Boiler Walls

No. 4586—4 p. folder (431) on sectionally supported wall for the upper side wall areas of bent tube boilers, which "permits freedom of expansion of the drums while maintaining a tight air seal around the drum ends and is universally applicable on such boilers either on existing or new installations."—George P. Reintjes Co., P. O. Box 856, Kansas City, Mo.

Copper and Copper Alloys

No. 4587—Technical data book on copper and copper alloys giving detailed descriptions of 45 of the manufacturer's principal alloys, including graphic charts showing complete range of physical properties, general and working properties, ASTM specifications which they meet, and typical uses and applications. Descriptions are also given of the manufactured forms available and there is a special section covering techniques for welding nonferrous alloys and for bronze welding ferrous metals.—Revere Copper and Brass Incorporated, 230 Park Ave., New York, N. Y.

Fans and Duct Boosters

No. 4588—16 p. bulletin (103) on industrial and exhaust fans, illustrating and describing construction and giving extensive tables of capacities and specifications for the numerous types shown. Also 12 p. bulletin (104) on mine fans and axial blowers giving information on uses, characteristics, construction, drive arrangements, dimensions, and capacities. Also, 8 p. bulletin (102) on duct boosters and stack fans, with information on construction, applications, capacities, and other technical data.—International Engineering, Inc., 1145 Bolander Ave., Dayton, Ohio.

Fuel Conservation

No. 4589—16 p. presentation on fuel conservation discussing the vital need for saving fuel for space heating and

Comfort your customers...

SLOW | FAST
DOLE VARI VENT
SAVE FUEL

● People are not going to be left out in the cold. The Government has—(1) approved the National Fuel Conservation Program which calls for replacement of inefficient units of all kinds, including vital air and vacuum valves; (2) allocated material with the result that you can again supply Dole Air and Vacuum Valves and some other necessary heating equipment.

Keep an eye peeled all winter for radiators which will deliver more heat simply by the replacement of a worn or faulty valve.

THE DOLE VALVE COMPANY
1901-1941 Carroll Avenue, Chicago 12, Illinois
Offices and Representatives in Principal Cities

THE FAMOUS No. 1A VARI-VENT AND No. 2B VARI-VENT VACUUM VALVE . . . TYPICAL OF THE POPULAR DOLE LINE

Now Being Shipped DOLE Air & Vacuum VALVES

On a world-wide proving ground no job has been too tough for GEROTOR

PRONOUNCED JER-O-TOR

GEROTOR

REG. U. S. PAT. OFFICE

HYDRAULIC PUMPS

GEROTOR is proving its prime importance abroad and at home . . . *Serving* on the war front with many vital war machines. *Conserving* on the home front, stretching every drop of oil in Quiet May Oil Burners.

MAY OIL BURNER CORPORATION, BALTIMORE, MD.

QUIET MAY OIL BURNERS

ON THE SEVEN SEAS . . .

Wherever our fighting ships and freighters go, K & M equipment goes along . . . to help bring them back again, *faster.* It's a story of dependability . . . stamina . . . extreme sensitivity . . . the successful development of our more than 65 years of specialization in pressure and fluid control equipment. Send for Catalog #66.

SPECIAL REPAIR DEPARTMENT. *If you can't get new K & M valves and controls, send us your old equipment for repair. By George, we'll do it fast . . . 10 days to 2 weeks, maximum!*

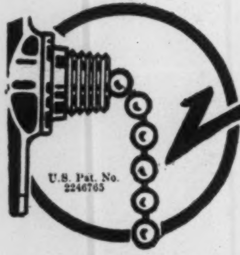
KM

KIELEY MUELLER ESTABLISHED 1879

KIELEY & MUELLER, INC.

PRESSURE & FLUID CONTROL SPECIALTIES

NORTH BERGEN, NEW JERSEY



BEAD CHAIN-DRAIN

FLEXIBLE SYPHON

EXCLUSIVE FEATURE - PATENTED PRINCIPLE
"DROP-BY-DROP" Drainage

Only **M. S. LITTLE**
RADIATOR
AIR VALVES
have this Fuel Saving Feature!

The War Production Board recognizes the importance of fuel saving Radiator Air Valves to this year's Fuel Conservation Program. Materials allotted to us make it possible to produce No. L-151 and L-50 (Fuel Saving Tested Valves) to the same material specifications used prior to the war.

Now Available!

No. L-151 ADJUSTABLE. "Finger-Tip" Multi-Control (40) Adjustments. FUEL SAVERS!

No. L-50 NON-ADJUSTABLE. Improve the efficiency of one pipe heating systems with No. L-50.

Look for the
BEAD CHAIN - DRAIN — FLEXIBLE SYPHON — the M. S. LITTLE MFG. CO. patented principle of "Drop-by-Drop" Drainage. Fuel Saving Air Valves.

FOLDER describing the line of Radiator Air Valves available upon request.

40 35 30 25
LITTLE MFG. CO. L-151
M.S. Little Mfg. Co. Hartford Conn.
U.S. PAT. OFF. NO. 2246765

No. L-151 Adjustable

L-50
M.S. Little Mfg. Co. Hartford Conn.
U.S. PAT. OFF. NO.

No. L-50 Non-Adjustable

MADE BY M.S. Little
TUBULAR BRASS PLUMBING GOODS
HEATING SPECIALTIES
THE M. S. LITTLE MFG. CO. HARTFORD, CONN. U. S. A.

how this can be accomplished with the manufacturer's regulators without any need for priority. Compiled in graphic style, simple charts and diagrams tell how these controls govern heating according to the outside weather and how time of morning warmup and night shutdown are varied automatically. According to the booklet, such controls can reduce fuel consumption from 15 to 20 per cent.—Marsh Tritrol Co., 600 S. Michigan Ave., Chicago 5, Ill.

Humidifiers

No. 4590—8 p. bulletin (158) giving engineering data and complete details on unit steam type humidifiers, showing results obtained by automatic humidification for prevention of loss of weight, strength, or quality in hygroscopic materials; for improving workability of materials; for controlling drying processes; for static control to prevent explosion hazard with dust and inflammable liquids and gases; and air conditioning service for maintaining healthful and comfortable working conditions. Also included are operating features, installation data, and other information on these units.—Armstrong Machine Works, Three Rivers, Mich.

Oil Burning for Heating and Power

No. 4591—Pocket size data and memorandum book in which is assembled pertinent information on combustion and oil burning for heating and power with numerous tables, graphs and charts. A wealth of practical data is given in compact form.—Preferred Utilities Co., Inc., 1860 Broadway, New York 23, N. Y.

Pipe Wall Thickness

No. 4592—16 p. bulletin (43-A) presenting a simplified method for calculation of pipe wall thickness for various pressures and temperatures based on ASTM and API specifications and the ASA code for pressure piping. Tables are given of the values of the factor K for power piping systems, gas and air piping systems, oil piping systems within refinery limits, and oil piping systems outside refinery limits. There are also three full page tables giving a comparison of various standards for pipe wall thickness.—Midwest Piping & Supply Co., Inc., Second and Barry St., St. Louis 4, Mo.

Signal and Warning Lights

No. 4593—24 p. catalog (43) on "Dialco" pilot light assemblies for all purposes, with information on construction and uses of some of the numerous types available from the manufacturer.—Dial Light Co. of America, Inc., 92 West St., New York, N. Y.

Speed Reducers

No. 4594—12 p. catalog (643) on "Saco" speed reducers with information and illustrations showing construction in detail, data on selecting proper type and size, and tables of dimensions and capacities.—Stephens-Adamson Mfg. Co., 55 Ridgeway, Aurora, Ill.

Straightening and Bending Presses

No. 4595—38 p. bulletin (320-A) on hydraulic straightening and bending presses, describing and illustrating each different machine and indicating its versatility in many kinds of operations. Numerous tables of work capacities augmented by engineering tables and other technical data are included.—Watson-Stillman Co., 140 Aldene Rd., Roselle, N. J.

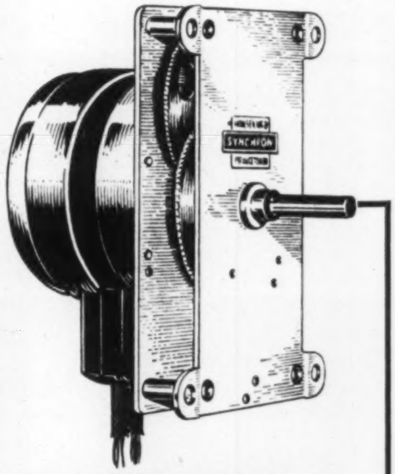
Unions

No. 4596—6 p. bulletin on unions for 300 psi, illustrating and describing their features in detail and giving sizes and list prices for both iron and brass seat.—Jefferson Union Co., Inc., Lockport, N. Y.

Vacuum Cleaning Systems

No. 4597—8 p. bulletin (D-4) on "Exidust" central vacuum cleaning systems for industrial plants and build-

for STOKER CONTROLS
INDUSTRIAL OVEN AND AIR CONDITIONING CONTROLS
STACK DRAFT CONTROLS
RECORDING THERMOMETERS
TIMING MACHINES AND SWITCHES
You can depend upon



SYNCHRON

Timing Machines for Lasting Efficiency and Complete Customer Satisfaction

This compact, accurately constructed SYNCHRON Time Machine is built to withstand the punishment of constant operation. Powerful enough to operate all types of Timing Controls, yet small enough to fit in the palm of your hand!

---- ● ----

SYNCHRON Timing Machines will operate at standard intervals of 1 RPM, 1 RPH, 1 RP12H, and 1RPD. Other intervals available if desired.

---- ● ----

And SYNCHRON Timing Machines are easy to install. Just connect the cam shaft with the device, and wire to electric current. Rigid ears on frame are punched for screw-mounting from front or back.

Powered by the Famous SYNCHRON "600" Motor

SYNCHRON
Tiny Timer

Synchronous, self-starting, self-lubricating, with steel pinions, brass gears, and exclusive oil-impregnated double bearings. Never needs oiling. Operates evenly in temperatures from 40 degrees below zero to 140 above.

---- ● ----

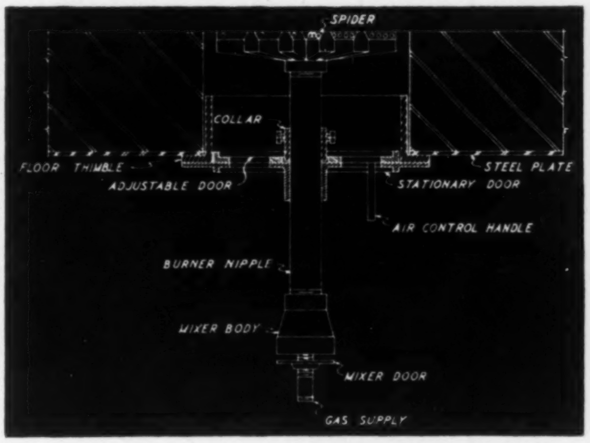
Design your timing control or recording device around SYNCHRON Timing Machines and Synchronous Motors. We're busy—on special assignments for the Army Air Forces and the Navy—but we can probably take care of your needs. Write for the new SYNCHRON Catalog.

HANSEN MANUFACTURING CO. INC.
PRINCETON 6, INDIANA

SYNCHRON

TIMING MOTORS—TIME MACHINES

JOHN ZINK BI-MIX BURNER for FLOOR FIRING


SPIDER
COLLAR
FLOOR THIMBLE
ADJUSTABLE DOOR
STEEL PLATE
STATIONARY DOOR
AIR CONTROL HANDLE
BURNER NIPPLE
MIXER BODY
MIXER DOOR
GAS SUPPLY

JOHN ZINK VBM — Gas Type

The John Zink VBM — Gas Type Burner fires a furnace to a higher rating — more evenly — than any other way possible.

It burns with an extremely short flame.

Performs well with extremely low draft.

Its special construction makes for better distribution of air for combustion.

In large sizes the VBM can be used for access door — for inspection of furnace.

Sizes: 14″, 16″, 18″, and 20″ diameters.

The John Zink Oil Burners MTH or MTB are inserted through center of the spider, to make the John Zink VBM — Combination Type Burner.

●

"JOHN ZINK
Products Must Be Good"

Write for Details Now!

John Zink Co.
TULSA, OKLAHOMA

New York • Los Angeles • Detroit • San Francisco

PETRO
REG. U.S. PAT. OFF.

ON THE HOME FRONT

Most of the widely used items of Petro Oil Burning Equipment are currently available for replacement and for authorized new installation under W.P.B. regulations and ratings. Where we cannot ship at once, the delay is usually nominal.

Petro equipment includes:

DOMESTIC "CONVERSION" BURNERS
1 to 6 gal. per hour

LARGER "LIGHT (No. 3) OIL" BURNERS
general application type
6 to 18 gal. oil per hour

COMBINATION BURNER-GENERATOR UNITS
both steel and C. I. sectional boilers; forced warm air units; and instantaneous water heaters.

INDUSTRIAL OIL BURNERS
Manual - Semi Auto - and Automatic* for either un-heated or pre-heated industrial oils, up to 145 g.p.h. Built-in motor or belt drive.

****When pre-heated oils are burned the Petro Thermal Viscosity system insures consistent maximum combustion efficiency at all firing stages, automatically and reliably.***

Petro Engineering co-operation is still available. Research-development is active. When your post-war activities start, Petro will be ready for you.

OIL IS AMMUNITION
USE IT WISELY

Full data on Petro Industrial Burners are in our Catalog—see Sweet's or Domestic Engineering Catalog Files—or we will gladly send copies on request.

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD CONNECTICUT

ings, outlining the benefits of this type of system and explaining the special features and details of the equipment.—Allen Billmyre Co., 431 Fayette Ave., Mamaroneck, N. Y.

Welding

No. 4598—12 p. issue of Sparks (Vol. 2, No. 2) presenting in words and pictures the "success story of welding" in the shipbuilding industry. There are about 50 miles of piping in the average ship and this bulletin shows how welding fittings are enabling shipbuilders to speed up the enormous job of piping installation and also save weight and space.—Tube Turns, 238 E. Broadway, Louisville, Ky.

Welding Positioners

No. 4599—4 p. bulletin (QW-116) on special welding positioners built to the requirements of the particular job, showing several illustrations of their uses.—Quickwork Div., Whiting Corp., Harvey, Ill.

CED Reports on Settlement of Terminated War Contracts

The ability of business to provide jobs for homecoming soldiers will depend to an important degree on whether adequate machinery is set up now to promptly free funds which hundreds of thousands of firms will have tied up in war contracts at the close of the war, it is stated in the first report of the Committee for Economic Development, 285 Madison Ave., New York 17, N. Y. Single copies of the report may be had on application to the CED.

Pointing out that at the present time there are 100,000 prime war contracts and several times as many subcontracts, aggregating $60 to $75 billions with inventories of from $10 to $15 billions, the report states that after the government cancels these contracts, "Needless delay in the release of business funds will cause needless unemployment."

At the close of the last war there were approximately 32,000 war contracts aggregating $5 billions and despite strenuous efforts of government officials to expedite settlements, there were more than 7000 unsettled contracts a year after the war ended. Average time to settle a claim that was taken to court was 3½ years, the report reveals.

Prompt release of funds when the war is over to enable business to put people to work producing peacetime goods, is one of the major problems facing the nations, the CED report indicates, and goes on to recommend consideration by Congress of a four-point program to forestall the emergency which will arise when wholesale cancellation of contracts begins:

1) *Creation by Congress of a contract settlement board.*
2) *Decentralize administration of contract settlement procedure.*
3) *Prompt recourse to the courts in case of dispute.*
4) *Mandatory loans to contractors and subcontractors.*

The CED report views the settlement of terminated war contracts as one of the most vital postwar problems to be solved before this country can achieve prosperous peacetime conditions. It recognizes, however, that there are other questions to be dealt with such as the demobilization of our armed forces and war workers; provision for adequate compensation for workers temporarily unemployed during the transition period; liquidation of wartime controls; disposal of government owned plants; reorganization of the federal tax structure; and others.

Measuring the Cooling Power of Air

Methods of determining the cooling power of air are described in a paper entitled On the Practical Evaluation and Interpretation of the Cooling Power in Bioclimatology (I), by Robert G. Stone, of the Blue Hill Observatory, Harvard University, published in the October 1943 Bulletin of the American Meteorological Society, Milton, Mass.

The author discusses at some length the kata thermometer, invented by Dr. Leonard Hill in 1913, and other c.p. instruments.

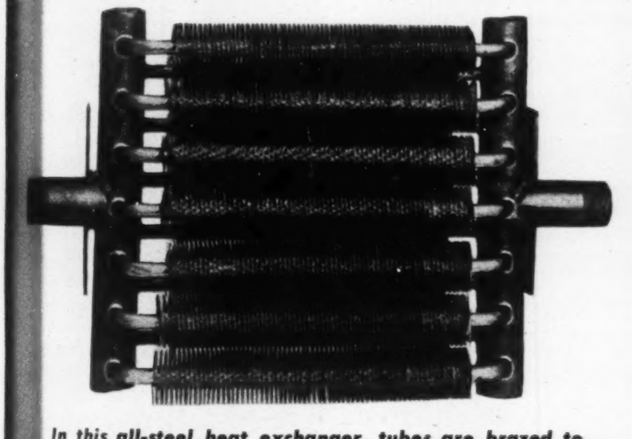
• TOMORROW •
• TODAY •

You're set for many metal joining situations when you braze with

SIL-FOS and EASY-FLO

Metal restrictions or no metal restrictions, many metal joining problems are quickly solved when you use Sil-Fos and Easy-Flo. You can change from non-ferrous to ferrous metals, if necessary, and back again without changing your brazing procedure.

This was the fortunate position of many manufacturers who were using Sil-Fos and Easy-Flo in the construction of heat exchangers and heating and air conditioning equipment when the war production crisis created metal restrictions. Where it was necessary to change from bronze and copper to steel or steel and iron, they were able to make the change without altering their brazing methods. They simply turned the whole job over to Easy-Flo (Sil-Fos brazes only non-ferrous metals) and continued to get the same fast, reliable, economical production as before.



In this all-steel heat exchanger, tubes are brazed to headers with Easy-Flo. Their ability to make virtually indestructible, leak-tight joints reliably and economically explains why these silver brazing alloys are so extensively used on work of this character.

Join the large and expanding list of manufacturers who have standardized on versatile, dependable, low-cost Sil-Fos and Easy-Flo brazing. As a first step,

SEND FOR BULLETIN 12-A

It gives full details and will be mailed to you on request. Write for your copy today.

HANDY & HARMAN
82 FULTON ST., NEW YORK 7, N. Y.
Bridgeport, Conn. • Chicago, Ill. • Los Angeles, Cal. • Providence, R. I. • Toronto, Canada
Agents in Principal Cities

Mortite UTILITY TAPE

HUNDREDS OF USES

★

**INSULATES • WEATHERSTRIPS
PLUGS UP CRACKS • MAKES PACKING
OR GASKETS • CAULKS CASEMENTS
GLAZES WINDOWS**

This new pliable plastic does not crack, chip, dry out or shrink. Easy-to-handle, unrolls like ribbon and is ready for use, inside or outside. Can be painted.

SIMPLE TO APPLY

Mortite adheres to any clean, dry surface. No tacking or tools needed, just press into place and it stays put.

About 80 ft. to a roll. Order through your supply house or $1.25 postpaid. ($1.40 west of Rockies.)

Circular Free

J. W. MORTELL CO.
512 BURCH ST.
KANKAKEE, ILLINOIS

STOP THAT DRIP

No More Damage from Condensation or Sweating Pipes, Tanks, Walls, Ceilings and Air Ducts

NoDrip A SURE CURE

• This sensational plastic cork coating prevents condensation drip from metal, concrete, brick, wood, plaster or composition surfaces. Permanently protects metal against rust and corrosion, thus prolonging life of pipes, tanks, etc. Forms a moisture-proof, insulation type coating impervious to acid and alkali.

Stucco-like finish requires no maintenance. A gallon covers about 30 feet of ½" pipe. Dries in 24 hours. Comes in 1, 5 and 55 gallon drums. Immediate Shipment. Order from your Supply House.

FREE NoDrip Circular about Condensation Drip and its Prevention.

APPLY WITH BRUSH, TROWEL OR SPRAY

J. W. MORTELL CO.
Technical Coatings Since 1895
512 BURCH ST. KANKAKEE, ILL.

Make Good Piping Better with WELDOLETS · THREDOLETS

3 Types Meet Every Need

WeldOlets for butt welded branch connections.

ThredOlets for screwed branch connections.

Socket-End WeldOlets for socket-type welded branch connections.

Save Weight
WeldOlets, ThredOlets keep the weight of any piping system to a minimum. Fewer flanged joints mean less possibility of leaks.

Gaskets, Bolts, Nuts
Maintenance eliminated when WeldOlets, ThredOlets are used—no need to change gaskets, tighten nuts and bolts.

Flow Improved
Funnel-shaped intake aperture of WeldOlets, ThredOlets improve flow conditions, reduces turbulence and friction.

Vibration
Due to light weight and improved flow conditions, vibrational stresses are reduced, possibility of leaks eliminated when WeldOlets, ThredOlets are used.

WeldOlets, ThredOlets and Socket-End WeldOlets are suitable for all commonly used pressures and temperatures in every type of piping system. They are installed either before or after erection of the main line—and always with ease and economy. They are equally well adapted to pre-fabricated or "on-the-job" assemblies. Stocked for all standard pipe sizes up to 12" in size-to-size and reducing sizes—and can be supplied on special order for pipe up to 24". Stock fittings are drop forged steel, but to meet special conditions will be supplied in Monel, Everdur, Toncan Iron, wrought iron, etc.

Bulletin WT31 gives detailed information about all the advantages of WeldOlets, ThredOlets and Socket-End WeldOlets. Write for your copy today.

Forged Fittings Division
BONNEY FORGE & TOOL WORKS
ALLENTOWN, PA.

ARMY E NAVY
Star Awarded
July 10, 1943

WELDOLETS·
THREDOLETS
Welded Outlets for Every Piping System

• NEW BOOKS & REPORTS •

Factors for Calculating Radiant Heating and Cooling

Radiant Heating and Cooling (Part I, Angle Factors for Calculations), by C. O. Mackey, L. T. Wright Jr., R. E. Clark, and N. R. Gay, is the title of a bulletin recently issued by the college of engineering of Cornell University, Ithaca, N. Y. Identified as bulletin No. 52, it is dated August 1943. Copies may be obtained for 40c.

The bulletin is first of a series which is planned to present results of investigations of the economy and comfort of radiant heating and cooling. This study, supported by the Consolidated Edison Co., is being carried out under the direction of a research committee appointed from the teaching staff of Cornell.

This first bulletin supplies preliminary engineering data necessary in the study of radiant heat exchanges within a room. There are many other uses of these data, including the study of radiant heat exchange within a boiler furnace and studies of illumination. Charts are presented for angle factors from plane surface to plane surface and from a small sphere to plane surfaces. Tables are given of the angle factors for the surfaces within a specific test room.

It is the purpose of later study to investigate engineering factors in a model room and eventually to present physiological and psychological data, as well as engineering data obtained from a study of human subjects in a test room to be built in the constant temperature room of the Sibley school of mechanical engineering at Cornell.

Standards for Steel Piping Materials

The 1943 edition of ASTM Specifications for Steel Piping Materials is a compilation of all of the specifications issued by the American Society for Testing Materials covering these materials and includes 44 standards and 25 emergency alternate provisions that have been issued to aid in expediting procurement. Many of the specifications and emergency provisions are part of schedules appended t WPB limitation order L-211.

There are 10 specifications on boiler, superheater, an miscellaneous tubes. Sixteen cover various types of pipe five cover still tubes for refinery service and heat exchange and condenser tubes; and five specifications widely used in the field of carbon alloy steel castings for valves, flanges and fittings are given. There are four specifications covering forgings and welding fittings. Of the four standards for bolting material, one is included for the first time, covering heat treated carbon steel. The book is complete wit the austenite grain size classification chart for steels.

Copies of this publication can be obtained in heavy paper cover from ASTM headquarters, 260 S. Broad St., Philadelphia 2, Pa., for $1.75 per copy.

Tungsten: Its History and Its Applications

During 1942, 92 million tons of iron ore moved o through the Soo locks—a new record of production a transportation, and a most valuable and essential factor i America's unparalleled war effort. The achievemen of the iron mines and Great Lakes steamship operators we widely proclaimed. In June 1940, four shiploads of tung ten ore moved out of Hanoi, French Indo-China, under th covetous eyes of the Japanese, whose consternation reache such bounds that for three days their cruisers followed th four freighters. The ore shipment resulted from the aler ness of K. C. Li in calling attention of the American go ernment to the likelihood of the ore falling into the han of the Japanese unless prompt action was taken to acqui ownership and initiate shipment. This event was given publicity, but is of an importance almost ranking with t iron ore accomplishment.

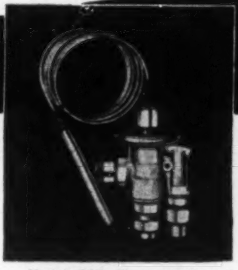
Many other facts pertaining to the significance of tu

REFRIGERATION-AT-WAR . . .

PRE-TESTING FABRICS in SYNTHETIC ARCTIC WEATHER

EPENDABLE
REFRIGERANT VALVES

hermostatic Expansion—Solenoid—Constant Suction Pressure — Water egulating—"Trap-Dri" System Protectors — Water Solenoids — Cooling Thermostats.



Model 205 Thermostatic Expansion Valve

• "Synthetic Arctic Weather," refrigerated test chambers for pre-testing combat clothing, fabrics, guns and equipment, is but one of many precision-control applications of A-P Dependable Refrigerant Valves . . . saving time, money, and lives today.

A-P DEPENDABLE Refrigerant Valves are a highly vital part of many of today's refrigeration and air conditioning systems. Their long-established reputation for accurate and dependable refrigerant control, and for smooth, "service-free" operation, is an efficiency that you will want to add to YOUR systems — both on new installations and for replacement purposes. A-P valves are available in all capacities, for Freon, methyl chloride, and sulphur dioxide.

Remember, too, when you want effective system protection, the A-P "Trap-It" and "Trap-Dri." Placed ahead of every expansion valve, they effectively trap all system impurities and moisture — permitting smoother valve operation and preventing freeze-ups. . . . *Write for details.*

DEPENDABLE
REFRIGERANT VALVES

UTOMATIC PRODUCTS COMPANY
60 North Thirty-Second St. Milwaukee 10, Wisconsin
xport Dept. . . . 15 East 40th Street, New York 16, New York
cked and sold by progressive refrigeration jobbers everyere, used and recommended by leading service engineers.

DRIVE OUT THE

—FROM ALL ROTATING PARTS

with the NEW

BEAR DY-NAMIC BALANCING

DRIVE OUT
Excessive Wear
Vibration
Noise
caused by
Couple-Force Action

The new, but thoroughly proven principles embodied in Bear Dy-Namic Balancing Machines make possible a much simpler, easier, faster, lower-cost method of Dy-Namically Balancing any size rotating part from 4 oz. up to 4,000 lbs.

Write, Phone or Wire for this

NEW FREE DATA FOLDER

See the wide variety of types, sizes and models of Bear Dy-Namic Balancing Machines available to those with war industry priorities.

This folder also provides valuable data on how you can use Bear Dy-Namic Balancing in two ways, *First*—as a manufacturer of Ventilating and Air Conditioning Products—to make Armatures, Blowers, Flywheels, Fans, and other rotating parts run more smoothly and quietly . . . perform better . . . and last longer. *Second*—on your own Production Machinery, to insure precision, smoother operation, less frequent adjustment and greater power conservation.

When sending for this Free Data Folder, also tell us details of your balancing problems. Address Bear Mfg. Co., Dept. HPV, Rock Island, Illinois.

DY-NAMIC BALANCING of Rotating Parts
BEAR MANUFACTURING COMPANY

BEAR
COMBINATION
STATIC AND DY-NAMIC BALANCING MACHINES

sten to World Wars I and II are related in the brief but fascinating foreword which Mr. Li has written to the excellent metallurgical text which he and Chung Yu Wang have just completed.—Tungsten: Its History, Geology, Ore Dressing, Metallurgy, Chemistry, Analysis, Applications, and Economics. The book was prepared and published under the sponsorship of the American Chemical Society, and is a thoroughly exhaustive treatment of this rare but important metal. The element tungsten was recognized and isolated in the 18th century; its use for hardening steel was attempted as early as 1855; in 1900 the Bethlehem Steel Co. exhibited tungsten tool steel at the Paris exposition. Yet up to 1914 the British considered wolframite (tungsten ore), as dross in the Cornwall tin smelteries and were glad to dispose of it to the Germans for a pittance. That tungsten permitted Germany to produce ordnance with high speed tool steels at rates that astonished the Allies.

About a third of the book, some 90 pp., is devoted to the geology of the metal. Aside from the scientific considerations, always of deep interest to those versed in that science, it is brought out that while tungsten ore is found in perhaps 30 countries, China possesses, according to one authority, at least 80 per cent, and according to another, over 95 per cent of the world's resources. To date, China has been the source of 37 per cent of world production, Burma of 17 per cent, the United States 11 per cent, the remaining 35 per cent coming from 10 countries.

Two chapters totaling 110 pp. discuss the ore dressing and metallurgy of tungsten. Two more chapters, with 46 pp. treat, of its chemistry and analysis. Then 22 pp. are given to the industrial applications of tungsten, and the practicing engineer will gain his information as to how this metal is utilized. The authors consider six categories of uses; ferrous alloys, nonferrous alloys, tungsten carbides, electrical equipment, tungsten compounds, and miscellaneous. By far the two most important single uses are as high speed alloy steels and as tungsten carbide, for metal turning. Of the ferrous alloys, besides high speed, there are those employed in wire drawing dies, magnets, heat resisting valves for internal combustion engines, and pneumatic battering and hot work steels. In nonferrous alloys, stellite (a cobalt-chromium-tungsten mix) has metal cutting qualities resembling those of carbide; others have special uses because of heat or abrasion resisting properties in tools, welding equipment, magnets, and special structures. Tungsten carbide is neither ferrous nor nonferrous alloy, since it is a chemical compound of tungsten and carbon. The chief electrical utility of tungsten is in filaments and contact points. Chemically, tungsten compounds find application in dyeing and paint pigments. The most rare and expensive porcelain known was made centuries ago in China and owes its value to tungsten pigments which have not since been reproduced. The concluding pages are devoted to economic and factual data on tungsten.

The book is published by Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y., contains 325 + xvii 6 x 9 in. pp., and sells for $7.00.—*K. S.*

Patent Law

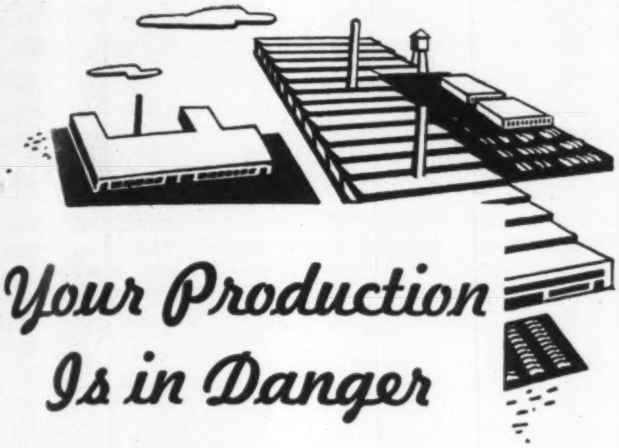
In his preface, the author of Patent Law, Chester H. Biesterfeld, states that his book is an outgrowth of a series of lectures given by him at the University of Delaware and that it is designed primarily for chemists, engineers, and students desiring an understanding of patent law.

To exhaust the law relating to patents, many volumes are required. In reducing these volumes to one volume of 225 pp., many choices of material had to be made and broad statements necessarily are used at times that might lead to controversies were this book intended for court use. As an introduction to the law of patents for laymen who can use it with a mental reservation that the last word may not have been spoken by the courts and that many phases of patent law are still open for final interpretation and decision, Mr. Biesterfeld's book should be very useful and helpful. He has covered the ground broadly and interestingly and has chosen his material well.

THE MANAGEMENT AND EMPLOYEES
OF THE
Burnham Boiler Corporation
Are United in Wishing You
A MERRY CHRISTMAS · HAPPY NEW YEAR
AND VICTORY IN 1944

Irvington, New York **Zanesville, Ohio**

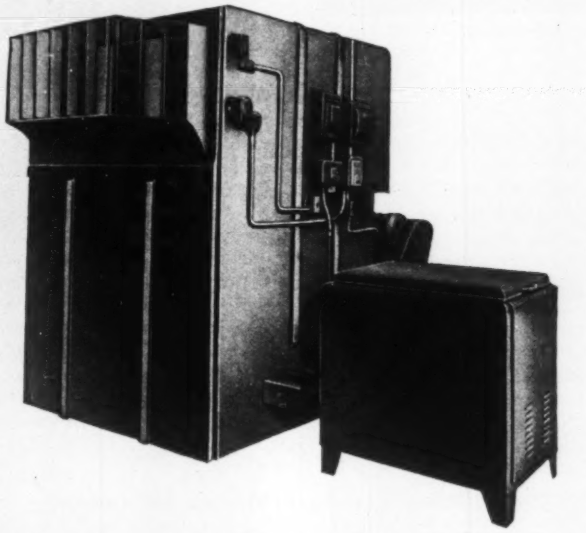
Baltimore 18, Md.
Cambridge 39, Mass.
Chicago 24, Ill.
Elizabeth 4, N. J.
Geneva, N. Y.
Lancaster, Pa.
Philadelphia 32, Pa.
Pittsburgh 21, Pa.
Springfield 1, Mass.



Your Production Is in Danger

Shivering employees in cold, drafty rooms cannot work at top speed and accuracy. Install a Directherm Unit Heater. It will keep your plant warm—EVENLY warm—and the morale up. Absentee sickness costs many times more than a Directherm.

It Is Not too Late for This Winter If You Order Immediately



DIRECTHERM UNIT HEATERS

Made in six sizes (300,000—1,700,000 BTU). For coal, gas, and oil. No pipe or duct work. Easy installation. Automatic controls. No maintenance.

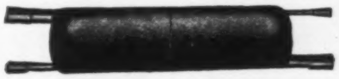
AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. ST. LOUIS 10, MO.

25 YEARS' SERVICE TO THE INDUSTRY

ACME PRODUCTS

Refrigeration and Air Conditioning Equipment

HEAT EXCHANGERS
SUCTION LINE



INCREASES EXPANSION VALVE CAPACITY . . . PREVENTS LINE VIBRATION AND CHATTERING VALVES . . . OFTEN INCREASES COMPRESSOR CAPACITY . . . PREVENTS LIQUID RETURN TO COMPRESSOR . . . ELIMINATES SUCTION LINE SWEATING.

Sixteen Standard Sizes up to 180 Tons. Catalog No. 12

EVAPORATIVE CONDENSERS
All prime surface cooling coils. Copper or Steel.

AMMONIA CONDENSERS
Shell and Tube—Horizontal or Vertical.

FREON SHELL and TUBE CONDENSERS
Capacities 2½ to 450 Tons—Steel or Copper Tubes.

DIRECT EXPANSION WATER CHILLERS
Indirect Air Conditioning and Processing Water

FLOODED WATER CHILLERS
Drinking and Ingredient Water

HI-PEAK WATER COOLERS
Storage type, Direct Expansion

CASCADE WATER COOLERS
Aerator Type, Bottling Plants

BRINE COOLERS
Steel Tubing or Pipe

FINNED COILS
Air Conditioning—Low Temp.

PIPE COILS
Steel—½" to 2"

HEAT INTERCHANGERS
Refrigerant Suction Line—Liquid to Gas

OIL SEPARATORS
Separators—Not Traps

LIQUID RECEIVERS
Refrigerant

FORCED CONVECTION UNITS
Cold Dispensers

ACCUMULATORS
Refrigerant

SURGE DRUMS
Refrigerant

SHELL and TUBE HEAT EXCHANGERS
Liquid to Liquid—Gas to Gas, etc.

WRITE FOR CATALOG ON ANY OF THESE PRODUCTS

ACME INDUSTRIES
JACKSON • MICHIGAN

Your Search is Ended

HERE IS A **FLOW METER** that **CANNOT BE DAMAGED** by sudden overload or Reverse Flows

If you are looking for a flow meter that you don't have to pet and pamper—a meter that will stand the gaff of sudden overloads or reverse flows, you will find your answer in the ADSCO Flow Meter of the orifice type. Here is a meter that you can depend on to maintain its accuracy under the most severe operating conditions.

Whether you measure steam, water, compressed air or high pressure gas flows, its exclusive, simplified "free floating" meter mechanism gives it sustained operating accuracy over an exceptionally wide range of flow. Records and totalizes on direct reading, evenly divided daily charts.

Write us regarding your meter problems. Also ask for bulletin 35-83HP.

AMERICAN DISTRICT STEAM COMPANY
N. TONAWANDA, N. Y.
MAKING "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 60 YEARS

ADSCO FLOW METERS
ARE SIMPLE AND RUGGED . . .
YET EXCEPTIONALLY
ACCURATE at all Rates of flow

He—perhaps unwittingly—assists those today who are interested in seeing drastic changes in the patent laws, or their repeal, by repeatedly coupling patents with monopoly. Through the patent laws, the public receives from the inventor, for the benefit of all, a creation or discovery which he might have kept secret and the public might otherwise never have had. Monopoly takes from the public something it has had for the benefit of a few. Monopoly is unlawful through both judicial and legislative action. Patents have given rise to our present industrial civilization.

The "flash of genius" mentioned as perhaps one of the elements of invention, may appear discouraging to engineers and chemists who well know the time and effort involved in trial and error testing before worthwhile discoveries can be brought out. It is hoped that this unfortunate phraseology of a recent Supreme Court decision can be clarified before the law of patents is judicially repealed.

Patent lawyers will find the book useful on familiarity as a quick lead to recent decisions and trends on points of law that are not indexed thoroughly in the more lengthy works on this subject.

The publisher is John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y., and the price is $2.75. The author is a member of the New York bar and of the bar of the District of Columbia.—*J. L. M.*

Introduction to Postwar Planning

In line with one of the major interests of business today, the policyholders service bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York 10, N. Y., has issued, as the first of a series of projected reports on the subject of postwar planning, a study entitled An Introduction to Postwar Planning. It is designed to put before business executives information that will, first, assist them in determining the need for postwar planning within their own organizations, and second, help them to define more accurately the scope of postwar planning activities that will best meet the need of their own situations.

Based on material developed from some 50 selected companies that have already inaugurated postwar planning programs, the survey has uncovered two distinct types of thinking. In some cases, it is believed that in order to make the planning assignment definite and to assure quick results, the scope of postwar planning should be arbitrarily limited—generally to the fields of product development and market research. On the other hand, a number of companies look upon postwar planning as an opportunity to analyze and appraise all phases of the company's operations in terms of estimated postwar conditions. The scope of such activities is virtually unlimited.

A copy of this report is available to executives who request it from Metropolitan Life on their business stationery.

WPB Publishes Salvage Manual for Industry

A comprehensive manual on industrial salvage has been published by the Technical Service Section, Industrial Salvage Branch, Salvage Division, War Production Board, and is being distributed to industry.

The new book, entitled Salvage Manual for Industry, contains 245 pp. of systematically organized and classified information and data—most of it of a "how-to-do-it" nature—on industrial salvage practice in all its ramifications. Material is presented in 26 chapters, grouped into six major sections. There are two chapters on organizing and planning the salvage department; three on the administrative factors; 12 on methods of handling (finding, identifying, segregating, collecting, reclaiming, storing, selling, etc.) metal scrap; three on non-metallic waste; seven case histories demonstrating exemplary practice; a 17 p. compilation of practical hints for handling specific waste materials; and a 9 p. index.

The book has been described by one authority as "a combination management manual and technical guide for salvage operations." It is procurable through the Superintendent of Documents, Government Printing Office, Washington, D. C., for 50c per copy.

You Can Say It With PRIDE
"IT'S AN AURORA PUMP"

Type AD Hor. Split Case, Two Stage Centrifugal

Type OD Hor. Split Case Double Suction Single Stage Centrifugal

NSA Aurora Centrifugal Sump Pump

Type GMC Close-Coupled Centrifugal

Type GGU Side Suction Single Stage Centrifugal

Aurora Pumps are the products of Experience. The Aurora Personnel has but ONE objective—the building of fine pumps. We are not jacks of all trades. We are exclusive pump builders. The splendid record of thousands of Aurora Pumps on a myriad of war services is your assurance that your post-war needs will be superbly taken care of as you, too, install "Pumps by Aurora."

Write for CONDENSED CATALOG M

APCO TURBINE-TYPE PUMPS—the simplest of all pumps. Ideal for small capacity, high head duties. Silent, compact and lasting.

APCO Single Stage Turbine-Type

APCO Horiz. Condensation Return Unit

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY
80 Loucks Street, AURORA, ILLINOIS

The January Directory Number

When you receive the next issue of HEATING, PIPING & AIR CONDITIONING you will receive a wealth of information that you will use every day during 1944.

Watch for this important issue and be sure it gets a permanent place on your desk. In addition to the big Directory Section, the editors have planned a full schedule of timely articles dealing with the war-time services of heating, piping and air conditioning in numerous installations.

Heating, Piping & Air Conditioning

JOIN-UP with SHEETLOCK

"FABRICATING METHODS"

"HOW TO MAKE DUCTS FROM NON-METALLIC MATERIALS"

Is Yours for the Asking

It has been proven, and we are of the firm opinion that the methods used in "FABRICATING METHODS" make the best ducts possible and at the same time at the very lowest cost. This eight-page booklet describes the latest improved methods of fabricating flexible or rigid non-metallic boards.

Write today for this illustrated informative booklet.

THE SHEETLOCK COMPANY
Manufacturers of Sheetlock Self-Fastening Metal Strip
4521 North Clark Street Chicago, Illinois

WING

WING AXIAL FLOW BLOWERS
Type EMD (Single Stage)

Used for statics up to 5" with volumes up to 35,000 cfm. Higher capacities can be furnished in special designs. Built-in volume control and re-directing vanes permit simplified capacity variation either manually or automatically. Falling horsepower characteristics with dampering. Motors are constant speed, fully enclosed and dustproof. Static efficiencies up to 70% and more. Uses: Forced draft for oil or gas burners, stokers, pulverized fuel, and hand-fired boilers. Mounted horizontally or vertically; on floor, or directly on windboxes or air preheaters.

L. J. Wing Mfg. Co.
14th St. & 7th Ave., New York, N. Y.—Factories: Newark, N. J.

Detect
Dirty
Filters
and Save
0 1 2 3 4 5
HAYS

with a HAYS AIR-FILTER GAGE

Why let dirt clogged filters decrease air-circulating efficiency and increase power costs when a Hays Air-Filter Gage will tell you when to change the filter? This gage indicates air-flow through filter at all times . . . it will signal when filters need cleaning or changing. It will also operate a damper to control air flow through the duct. Write 990 Eighth Ave., Michigan City, Ind., for A-F G. Bulletin.

The HAYS CORPORATION
SINCE 1901
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

AIR CONDITIONING NOZZLES

Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-616.

YARNALL-WARING COMPANY
107 MERMAID AVENUE
PHILADELPHIA 18, PA.

YARWAY

• WPB . . . OPA . . . PAW . . . Etc. •

[*Also see p.* 660 *in main editorial section*]

Order P-84 on Heating Repairs Clarified by Amendment

To clarify and simplify restrictions on plumbing and heating emergency repairs the War Production Board announced November 9 an amendment to order P-84.

The revised order makes it clear that all orders accompanied by an OPA rationing certificate are assigned an AA-5 rating; previous restrictions were interpreted to apply the AA-5 rating only to orders for rationed equipment which was to be used for replacement purposes.

List A of the order, which names the items of equipment which are rationed by OPA order 9A, is brought up to date and the OPA regulation itself is designated as the only authoritative statement as to what items are rationed.

Persons wishing to obtain steel and wrought iron pipe and steel sheets for use in making repairs may no longer use the CMP symbol MRO, maintenance, repair, and operating supplies. Maximum permitted amounts of this material which may be purchased under CMP regulation 4 have been increased sufficiently to meet requirements for maintenance and repair purposes.

Provisions requiring that replaced parts be turned in for salvage have been reworded to make it clear that replaced parts which can be repaired, other than on the job, should not be turned in for salvage.

Details of the order concerning sales of low valued items were also clarified by the revised order.

WPB Order L-41 Limiting Construction Is Re-Drafted

A completely re-drafted order L-41, which limits construction, was issued in simplified form by the War Production Board last month. The new language of the order is intended to make the restrictions more easily understandable by the public.

Typical of the language of the revised order is its introduction, explaining the purpose of L-41: "This order limits construction. It is necessary in order to conserve materials, construction equipment, labor, and transportation. In most cases, except where the construction is of a special kind, you must get permission from the War Production Board for construction."

The introduction goes on to explain that this permission is not to be confused with preference ratings or priorities: "If a construction job is allowed, either because it is not of the kind restricted by the order or because permission has been obtained, it may still be necessary to get preference ratings for the materials and fixtures which are needed. On the other hand, if you have ratings for materials, or materials on hand, you may still have to get permission to use them for a particular construction job."

In addition to simplifying the regulations and instructions, the revised order makes the following substantive changes:

1) The limit on farm construction, including residential, is placed at $1000. Previously, there were separate limits, farm residences not being considered part of the farm unit.

2) A limit of $200 is placed on any type of construction for which a higher specific limit is not authorized by the order. This overall limit formerly was $1000.

3) The exception, originally made by L-41-b, for the insulating of buildings, has been liberalized in accordance with WPB policy relating to fuel conservation. On the other hand, the exception covering the conversion of heating equipment from oil to coal has been eliminated because of the tight coal situation.

4) Minor capital additions under CMP regulation 5 in

certain of the more essential industrial plants are excepted from the L-41 restrictions.

5) In calculating costs to determine if a job is within specified L-41 limits, the cost of used materials, or the value of labor furnished free, need no longer be included.

6) Cost limits now refer to the calendar year, instead of to any consecutive 12 month period.

7) Installation of plumbing equipment rated on WPB-2631 (formerly PD-851) is permitted if the cost is under $200.

8) Schedule B, listing various kinds of construction relating to operations of farms, railroads, utilities, mines, etc., which may be begun without WPB permission, has been altered in several respects. Drilling of water wells, certain radio facilities, and timber access roads financed wholly or in part by defense highway appropriations have been added.

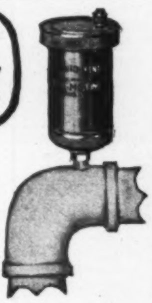
With issuance of the revised L-41, orders L-41-a, L-41-b, L-41-c, and interpretation No. 1 were revoked inasmuch as their provisions are either incorporated into, or altered by, the new order.

WPB Order Permits More Use of Aluminum

For the purpose of expanding permitted uses of aluminum, the War Production Board issued October 29 supplementary order M-1-i, as amended. The position of aluminum has now become sufficiently comfortable to permit the use of the metal in additional types of war and some essential industrial production, according to the WPB. This situation permits the use of aluminum for certain purposes where copper had been used, thus relieving the strain on supplies of the latter.

In January 1942 strict controls were set up confining the use of aluminum to war production. Recently, increasing output of the metal has permitted successive relaxations of the original order. This amended order is in line with this continuing process.

New permitted uses of aluminum include coils and fins

GET THAT AIR OUT OF THERE


With an
AUTO-VENT AIR ELIMINATOR

Circulation Troubles?

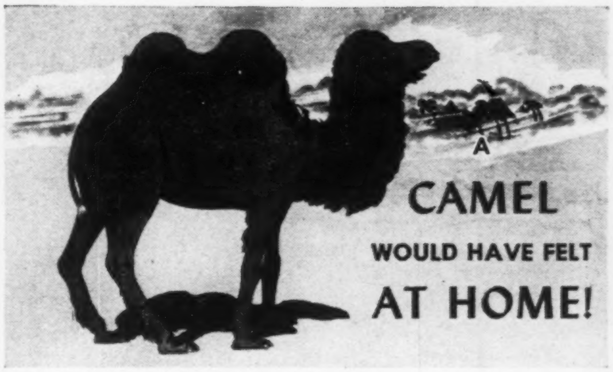
Why continually fight air pockets or traps in hot or cold circulating lines? You can "get that air out of there" *and keep it out* simply by installing the No. 7 Maid-O'-Mist Automatic Air Vent. This reliable air vent has a self-closing float-controlled valve and is designed especially for circulating pipe lines, concealed radiators, unit heaters, cooling manifolds, tanks, diesel engines, or any other application where air pockets or traps retard the free circulation of liquids.

Now available in bright brass finish.

APPROVED FOR NAVY, MARITIME COMMISSION AND ARMY USE.

MAID-O'-MIST INC.
211 NORTH ABERDEEN STREET
CHICAGO 7, ILLINOIS

AUTOMATIC HUMIDIFIERS
FOR ALL TYPES OF HEATING SYSTEMS



Until Allen Engineers Took Over...

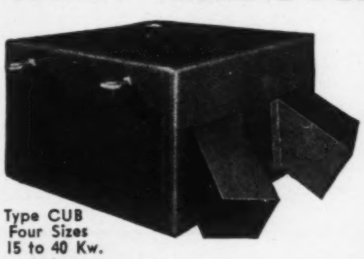
In a certain drop forge plant, under-roof temperatures in summer hit 170° to 190° Fahrenheit. Floor working temperatures were upward of 120°. O. K. for camels—tough on men intent on high production.

Allen men, wise to the ways of air movement, studied the situation. Seven 60 inch cowl ventilators that had been loafing on the job came off pronto. Equally fast, with the cooperation of local sheet metal men, seven 54-B Type "H" Allen Roof Fans went onto the ridge. With 60 air changes an hour, floor working temperatures moved down within reason, fumes and smoke that had been troublesome also took to their heels.

Allen men are always available to cooperate with you in determining ventilation needs and installing the proper equipment to meet the specific situation. The Allen Corporation, 9751 Erwin Ave., Detroit 13, Mich.

THE *Allen* CORPORATION
ENGINEERED VENTILATION FOR INDUSTRY

Keep workers healthy with ELECTRIC HEAT



Type CUB
Four Sizes
15 to 40 Kw.

Type UB
2 to 15 Kw.

Type HF
1.5 to 4 Kw.

ELIMINATE COLD CORNERS in shop and office, with Chromalox electric air heaters.

KEEP PRODUCTION IN HIGH by avoiding absences due to sickness. Grippe and colds are a form of sabotage. Don't give them a chance.

CHROMALOX *Electric* AIR HEATERS

FIT ANYWHERE they are needed, plugged in, or easily connected. A simple wiring job. No extra load on the steam boilers.

MANY TYPES and sizes, to heat anything from a large shop floor to a small office or gate house.

THERMOSTATIC CONTROL or manual switch as selected.

CHECK ON COST with our electric heat specialists. The savings may surprise you. Give us details of your heating need.

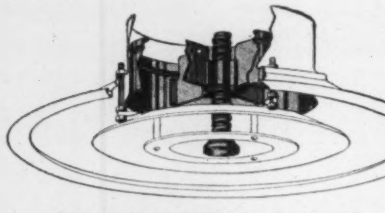
HEATING ELEMENT is the famous Chromalox unit, sturdy, dependable, used in hundreds of ways for industrial heat.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh 8, Pa.

KNO-DRAFT K-NEWS

AIR VOLUME CONTROL IS IMPORTANT, TOO

The effectiveness of air diffusion and distribution is increased by air volume control at each individual outlet—especially when such volume control does not alter the diffusion characteristics.



*Cutaway diagram of Kno-Draft*Air Diffuser equipped with Type Dee Air Volume Control*
Patents Pending

A *plus* in efficient diffusion, KNO-DRAFT Type DEE Air Volume Control is furnished completely assembled within the diffuser—adjusted and ready to operate. Descriptive Folder-R on request.

**Formerly known as Dorex Kno-Draft Air Diffuser*

WB CONNOR ENGINEERING CORP.

W. B. CONNOR ENGINEERING CORP.
114 East 32nd Street New York, N. Y.

Why wait?

The Herman Nelson Corporation, manufacturers of Heating and Ventilating products, whose advertisement appears on pages 34 and 35 of this issue, has positions available in several cities for sales engineers. Don't wait until after the war to establish yourself with a leading, responsible manufacturer in this industry. If you believe that you could fill one of these positions, send complete information about yourself to

ARMY E NAVY

THE HERMAN NELSON CORPORATION
Manufacturers of Quality Heating, Ventilating and Air Conditioning Products
MOLINE, ILLINOIS

for refrigeration and heating equipment, cooling fans for electric motors, for certain types of safety equipment, and for X-ray equipment. Other new uses permitted under the amended order include data and instruction plates not exceeding 0.035 in. in thickness, electric bus bars, bare electrical conductors, and current carrying accessories for conductors.

The order also permits aluminum ingot to be added to galvanizing baths, permits the manufacture of aluminum bottom boards for use in foundries and aluminum jigs and fixtures for use in the production of aircraft, as well as the use of aluminum in the manufacture of portable forest fire fighting equipment and portable power driven tree felling saws.

Special consideration will be given to requests for the use of aluminum in connection with approved programs of the War Production Board, where the use of aluminum would mean a substantial saving in man-hours from ore to finished product, the saving of a scarcer material, an increase in production, or increased efficiency of the product.

Two Schedules of Order L-126 Are Amended

Order L-126, schedule III (specifications for coil or tube assemblies for refrigeration condensers or coolers) and schedule IV (specifications for refrigeration valves, fittings, accessories, and other parts) were amended October 29 by the War Production Board.

Schedule III as amended corrects an error in a paragraph designation in the schedule as amended September 28, 1943. Schedule IV as amended makes certain changes in lists A, C, D, and E. Chief among these are:

The manufacture of water regulating valves of nonferrous metal, ¾ in. or smaller, is permitted. Suction pressure regulators are removed from the restrictions of the schedule. Two sizes of valves are added to the permitted sizes in item 11 of list A. Sleeves, guides, packing nuts, and adapters are added to the list of parts that may be made of nonferrous metal for use in accessories itemized in list D. An additional size flare nut is included in item 3 of list C.

Anti-Friction Bearings Not Frozen, Says WPB

It has been brought to the attention of the War Production Board that reports are circulating to the effect that anti-friction bearing deliveries have been "frozen" after a certain date. These reports are wholly unfounded, the WPB said last month.

The tools division of WPB has, however, recently taken steps to review the anti-friction bearing requirements of about 30 of the larger bearing consumers. These consumers were notified that they must secure WPB approval of deliveries of bearings requested by them for the months of December 1943 through May 1944. Such approval is required only as to types and sizes of bearings which the consumer wishes to receive in substantial quantities in connection with his authorized production schedules.

It is the desire of WPB to insure the realistic scheduling of bearing requirements of a substantial segment of users, and relieve the somewhat congested situation in bearing deliveries with consequent benefit to everyone concerned, as has been the case when similar techniques have been applied to other products.

New Schedule to L-272 Order Simplifies Industrial Thermometers

As a further step in the program of simplification of industrial type instruments, schedule VII (industrial and special purpose thermometers) was added to limitation order L-272 by the War Production Board last month.

The new schedule eliminates a number of sizes, types, and special features of industrial and special purpose thermometers. This action is expected to conserve critical man-hours in production and increase the quantity output of industrial thermometers as much as 10 per cent, the radio and radar division of WPB said. A small quantity of material also would be conserved by standardization and simplification.

The schedule restricts scale ranges in industrial thermometers between —40 F and +950 F to a definite list. It provides that cases and case fronts shall not be made of copper or copper alloy other than copper tubing, copper alloy tubing, or cylindrical extruded shapes.

M-43 Order on Tin Content of Solders Is Amended

The War Production Board issued November 3 general preference order M-43, as amended, relaxing restrictions on the tin content of solders where it has been found that higher tin content is necessary. Previously this higher content could be used only upon the granting of appeal, but under the amended order specific provisions permit higher tin content, in some cases above 21 per cent, for certain solders, thus reducing paper work. A survey has shown that the higher tin content solders permitted will actually result in a saving of tin.

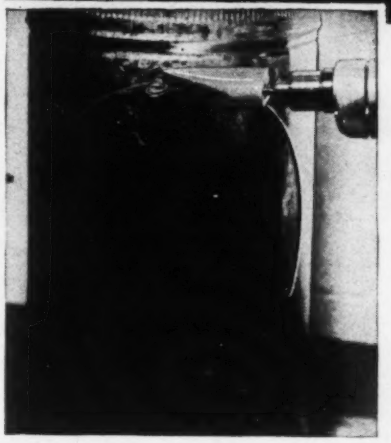
The amended order also permits the reworking of block tin pipe.

Commercial Standard for Forced Air Furnaces Announced

Under date of August 16, 1943, a proposed commercial standard for solid fuel burning forced air furnaces was circulated for written acceptance by the division of trade standards of the National Bureau of Standards. Since that time signed acceptances from a number of manufacturers, distributors, testing laboratories, and users, estimated to represent a satisfactory majority, have been received.

The bureau therefore announced last month that this standard, identified as CS109-44, may be considered effective for new production from March 10, 1944.

QUICK CUTTING



New
ROYAL CLIPPER
METAL CUTTER

Saves Time
Speeds the Job

Cuts most sheet metals up to .040" with ease.

Leaves a smooth, workable edge—no grinding or filing.

Removes less than 1/8".

Fits the chuck of any 1/4" pneumatic or electric drill.

Operates at twice drill speed.

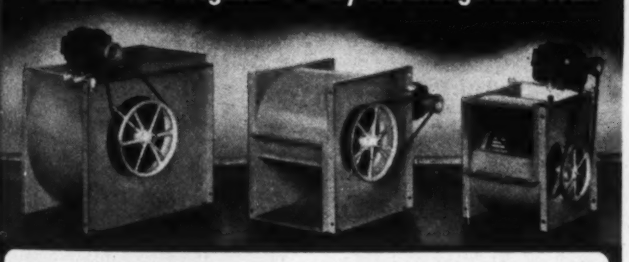
Small and compact—weighs only 1 1/4 lbs.

SPEED your metal cutting work with the new Royal Clipper. It cuts most sheet metals up to .040" in any pattern you desire—cleanly, quickly. Can be used as a scroll shear or for straight cutting. Order direct or through your jobber. Only $15.95.

Send for free "BULLETIN C" illustrating handy tools for sheet metal workers.

C-B TOOL COMPANY • Lancaster, Pa.

TRADE-WIND
QUAD
BLOWERS
For Air Conditioning
Ventilating, Heating, Cooling!
"QUAD" the original 4-way Discharge BLOWER



Leads the Field With These Outstanding Features!

- ★ Unit Steel Construction . . . rigid welded housing – no weaving or twisting!
- ★ Optional 4-way Discharge . . . on the job interchangeability to fit varying requirements!
- ★ Adjustable Bearing Oiler . . . easy oiling – always accessible!
- ★ Streamlined Inlet Fitting . . . quiet, efficient operation!
- ★ New Handy Motor Mount . . . quick positioning of motor and drive where most convenient and accurate tensioning of belt!
- ★ Balanced Blower Wheel . . . trouble free low cost operation!

Thousands of "Quads" are in daily use in War Plants throughout America

Since 1938 Trade Wind has pioneered the interchangeable blower design culminating in the new "quad" Blowers covered by patent #2268046—Dec. 30, 1941.

SEND FOR COMPLETE DATA SHEET!

For 10 Years Dependable as the Trade Winds

TRADE-WIND
MOTORFANS, INC.
5725 S. Main Street • Los Angeles 37, California

THIS IS THE STOKER THAT WON ITS FAME ON *INDUSTRIAL* JOBS!

★ Simple mechanically . . . the Frederick Stoker is especially rough-tough-and-rugged in construction. . . . Was designed first and primarily to withstand the rigors of heavy-duty industrial installations. And, among the several Frederick models, you'll find a Frederick Stoker that is designed for your needs—with a long success record on similar jobs. Ask about it; no obligation.

HOPPER or BIN FEED
200 to 850 LBS. PER HOUR
Clinker type, or Side Dumping Grate; Hopper or Bin Feed models.

FREDERICK
INDUSTRIAL STOKERS

The FREDERICK IRON & STEEL CO.
Eighth St., Frederick, Maryland

Centrifugal Pumps for All Purposes

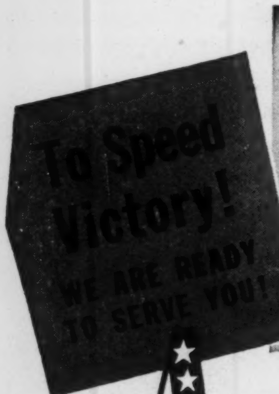
BIG CAPACITY
. . . in a small space

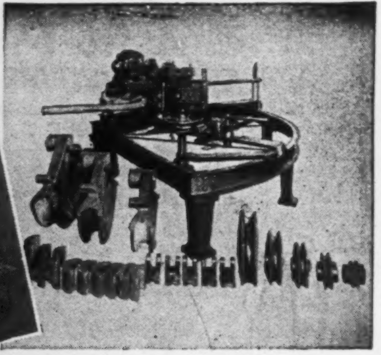
Here's a sensational improvement in centrifugal pump design—a pump of larger capacity, full efficiency, but easy to install where floor space is limited. Has many precisely engineered features, including:

1—High motor mounting—above floor splash and dirt.
2—Accessibility—complete rotor removable without breaking pipe connections.
3—Smooth operation—impeller spins between two bearings.
4—Flexible coupling—accessible stuffing box.
5—Standard motor—avoids prolonged shutdown as any stock motor is usable.
6—Handles all clear liquids—10 to 500 GPM. Heads up to 225 ft.

Write today for illustrated catalog D2-1042. Also ask for Economy's new Pump Data Book. Free to Plant Engineers and Executives.

ECONOMY PUMPS, Inc.
HAMILTON, OHIO


To Speed Victory!
WE ARE READY TO SERVE YOU!



"American"
COLD PIPE, CONDUIT and TUBE BENDING MACHINES

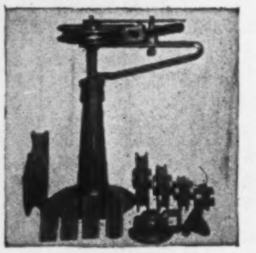
Twelve types to select from. Hand operated capacities ¼ to 6" inclusive. Motor operated ¾ to 8" inclusive.

A few of our More Than 12,000 Customers: Kaiser Shipbuilding Co.; Bethlehem-Hingham Shipyards; Portsmouth Navy Yard; Moore Drydock Co.; Stone & Webster Engineering Corp.; E. I. Du Pont de Nemours & Co.; West Penn Power Co.; Illinois Central Railroad; Federal Pipe & Supply Co.; Alabama Drydock Co.; Westinghouse Elec. & Mfg. Co.; Todd-Bath Shipbuilding Co.

Write Air Mail for printed matter.

"American" PIPE BENDING MACHINE Company INC

Quick Deliveries
51 PEARL ST.
BOSTON, MASS.



• MEETINGS & CONVENTIONS •

Refrigerating Engineers

American Society of Refrigerating Engineers, 39th annual meeting, December 7-9, Benjamin Franklin Hotel, Philadelphia, Pa. Program includes papers by R. E. Cherne, Carrier Corp., on cost of operation for refrigeration for air conditioning systems; by F. H. Munkelt, W. B. Connor Engrg. Corp., on air purification and recovery with activated carbon; by F. W. Hutchinson, University of California, on refrigerating design problems in marine installations; by J. W. Craig, Crosley Corp., on "Freon 22" and its application to low temperature refrigeration units; by J. R. Vernon, Johnson Service Co., on refrigeration units; by B. E. Proctor, U. S. Army, on dehydration and food compression; and by Douglas B. Kendrick, Lt.-Col., U. S. Army, on refrigeration applications for blood plasma and biologicals. There is to be a forum on December 9 at the Franklin Institute on future demands for refrigeration and air conditioning, new equipment to meet those demands, sales and distribution methods of the future, and the industry, the government, and the public. Headquarters office of the ASRE is at 50 W. 40th St., New York, N. Y.

Chemical Industries Exposition

Nineteenth Exposition of Chemical Industries: Week of December 6-11, Madison Square Garden, New York, N. Y. Exhibits featuring materials, products, processes, machinery, and apparatus for war and postwar production to be shown.

Warm Air Heating

National Warm Air Heating and Air Conditioning Association, 30th annual convention, December 8-9, Netherland Plaza Hotel, Cincinnati, Ohio. A feature of the convention will be a program arranged by the association's postwar information committee, the chairman of which is W. L. McGrath. Paul B. Zimmerman will report on the Indoor Climate Institute, H. F. Randolph will present a paper on radiant heating, and A. P. Kratz and S. Konzo will discuss research. Managing director of the NWAHACA is George Boeddener, 145 Public Square, Cleveland, Ohio.

Heating and Ventilating Engineers

American Society of Heating and Ventilating Engineers, 50th annual meeting, January 31-February 2, Hotel Pennsylvania, New York City. A special program dealing with the past, present, and future is being planned. See ASHVE Journal Section in this issue for further information. Secretary, A. V. Hutchinson, 51 Madison Ave., New York 10, N. Y.

Foundry Congress

American Foundrymen's Association, third war production foundry congress, week of April 25, Memorial Auditorium, Buffalo, N. Y. There will be exhibit booths for conference and consultation and displays of models, products, and equipment. Secretary of the AFA is R. E. Kennedy, 222 W. Adams St., Chicago, Ill.

★ ***The heavier grades of iron and steel scrap are urgently needed for community stockpiles. Help the victory scrap bank drive.*** ★

SECTION OF JANUARY, 1943, HEATING, PIPING & AIR CONDITIONING

1943 DIRECTORY

of

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT

for

INDUSTRY AND LARGE BUILDINGS

PART 1—PRODUCTS CLASSIFIED—Page 212

If you want to know the names of one or more manufacturers making a certain product, look in Part I, where products are classified alphabetically in "directory style" with the noun governing (for instance, "unit heaters" are listed under "heaters, unit").

PART 2—TRADE NAMES—Page 278

If you have the trade name of a product and want to know who manufactures it, look in Part 2, where trade names are alphabetically listed. Trade names the same as or identifiable from the company name are not listed. Manufacturers with such trade names can be easily identified under their product classifications in Part I.

PART 3—MANUFACTURERS' ADDRESSES—Page 292

For the complete name and address of any manufacturer look in Part 3.

● The manufacturers whose names are spotted throughout the listings advertise in this issue. See Index to Advertisers (on last page) for the page on which you will find the advertising of any of these manufacturers.

Heating, Piping & Air Conditioning
Chicago, Illinois

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS

PART 1—PRODUCTS CLASSIFIED

ABSORBERS, VIBRATION

See Hose, Metal, for Eliminating Compressor Vibration; Bases and Pads, Vibration Isolating

ABSORPTION DEHUMIDIFIERS

See Dehumidifiers, Absorption and Adsorption

ABSORPTION REFRIGERATION MACHINES

See Machines, Refrigeration, Absorption

ACCUMULATORS, REFRIGERATION (FOR AIR CONDITIONING)

●Acme Industries, Inc., Jackson, Mich.
American Injector Co., Detroit, Mich.
Betz Air Conditioning Corp., Kansas City, Mo.
Boester, Carl F., St. Louis, Mo.
Frick Co., Waynesboro, Pa.
●McQuay, Inc., Minneapolis, Minn.
Richmond Engineering Co., Inc., Richmond, Va.
Vilter Mfg. Co., Milwaukee, Wis.
●Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.

ADJUSTABLE WRENCHES

See Wrenches, Adjustable

ADSORBERS, ODOR

Airox Co., New York, N. Y. (Chemical for counteracting odors)
Betz Corp., Hammond, Ind.
Carbide and Carbon Chemicals Corp., New York, N. Y.
●Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.

ADSORPTION DEHUMIDIFIERS

See Dehumidifiers, Absorption and Adsorption

AFTERCOOLERS, COMPRESSED AIR

Adams Co., Inc., R. P., Buffalo, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Locomotive Co., Alco Products Div., New York, N. Y.
Andale Co., Philadelphia, Pa.
Annis Air Filters, Glendale, Cal.
●Bell & Gossett Co., Morton Grove, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Downingtown Iron Works, Downingtown, Pa.
Howard Iron Works & Alberger Heater Co., Buffalo, N. Y.
Ingersoll-Rand, New York, N. Y.
Johnson Corp., Three Rivers, Mich.
Parks-Cramer Co., Fitchburg, Mass.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Ruemelin Mfg. Co., Milwaukee, Wis.
Schutte & Koerting Co., Philadelphia, Pa.
Standard Heater & Oil Equipment Co., Jersey City, N. J.
Struthers Wells Corp., Titusville, Pa.
Tippett & Wood, Phillipsburg, N. J.
●Worthington Pump & Machinery Corp., Harrison, N. J.
●Young Radiator Co., Racine, Wis.
Zallea Brothers & Johnson, Wilmington, Del.

AIR AFTERCOOLERS

See Aftercoolers, Compressed Air

AIR BREAK FITTINGS

See Fittings, Drainage, Fixed Air Break

AIR CLEANERS

See Cleaners, Air, Electrical

AIR COMPRESSORS

See Compressors, Air

AIR CONDITIONERS

See Units, Air Conditioning

AIR CONDITIONING UNITS

See Units, Air Conditioning

AIR DIFFUSERS

See Diffusers, Air, High Velocity; Grilles; Registers

AIR ELIMINATORS

See Eliminators, Air

AIR FILTER GAGES

See Gages, Air Filter

AIR FILTERS

See Filters, Air

AIR SEPARATORS

See Separators, Air

AIR VALVES

See Valves, Radiator, Air

AIR VELOCITY METERS

See Meters, Air Velocity, Direct Reading; Anemometers

AIR VOLUME METERS

See Meters, Volume, Air and Gas

AIR WASHERS

See Washers, Air

ALARMS, HIGH AND LOW BOILER WATER

●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
●Kieley & Mueller, Inc., North Bergen, N. J.
●McDonnell & Miller, Chicago, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Photoswitch, Inc., Cambridge, Mass.
Schaub Engineering Co., Fred H., Chicago, Ill.
Wheelco Instruments Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

ALARMS, SMOKE

Au-Temp-Co Corp., New York, N. Y.
Bailey Meter Co., Cleveland, O.
Boiler Room Equipment, Inc., New York, N. Y.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Photoswitch, Inc., Cambridge, Mass.
Preferred Utilities Mfg. Corp., New York, N. Y.
Worner Products Corp., Chicago, Ill.

ALUMINUM SHEETS

See Sheets, Aluminum

ANALYZERS, CARBON DIOXIDE, PORTABLE

Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Barclay, Inc., Robert, Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Ellison Draft Gage Co., Chicago, Ill.
Engelhard, Inc., Chas., Newark, N. J.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●Hays Corp., Michigan City, Ind.

● Advertisement in this issue. See Index to Advertisers, page 306.

Hotstream Heater Co., Cleveland, O.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Permutit Co., New York, N. Y.
Precision Control Co., San Francisco, Cal.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., New York, N. Y.
Service to Industry, West Hartford, Conn.
Weaver Mfg. Co., Springfield, Ill.

ANEMOMETERS

American Instrument Co., Silver Spring, Md.
Barclay, Inc., Robert, Chicago, Ill.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
Hill, E. Vernon, Chicago, Ill.
•Illinois Testing Laboratories, Inc., Chicago, Ill.
Taylor Instrument Companies, Rochester, N. Y.
Willson Products, Inc., Reading, Pa. (Thermometer type)

ANGLE VALVES

See Valves, Angle

ANGLES, BARS, BEAMS, CHANNELS AND TEES (LIGHT WEIGHT SHAPES)

Aluminum Co. of America, Pittsburgh, Pa.
•American Brass Co., Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Brasco Mfg. Co., Harvey, Ill.
•Byers Co., A. M., Pittsburgh, Pa.
Carnegie-Illinois Steel Co., Pittsburgh, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
Columbia Steel Co., San Francisco, Cal.
Inland Steel Co., Chicago, Ill.
International Steel Co., Evansville, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
Lukens Steel Co., Coatesville, Pa.
Milcor Steel Co., Milwaukee, Wis.
Republic Steel Corp., Cleveland, O.
Revere Copper and Brass, Incorporated, New York, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Truscon Steel Co., Youngstown, O.
Weirton Steel Co., Weirton, W. Va.
•Youngstown Sheet & Tube Co., Youngstown, O.

AQUASTATS

See Thermostats

ARC WELDERS

See Welders, Arc

ARC WELDING ELECTRODES

See Electrodes, Arc Welding

ASBESTOS FIBER AND CEMENT PIPE

See Pipe, Asbestos Fiber and Cement

ASBESTOS PACKING

See Packing, Asbestos

BALANCING EQUIPMENT

See Equipment, Balancing

BALANCING VALVES

See Valves, Balancing

BALL BEARINGS

See Bearings, Ball

BAROMETRIC CONTROLS

See Controls, Draft, Barometric

BASES, MOTOR, TENSION ADJUSTING

Ackermann Mfg. Co., Wheeling, W. Va.
Alexander Bros., Philadelphia, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
•General Electric Co., Schenectady, N. Y.
Ideal Commutator Dresser Co., Sycamore, Ill.
Manley Products Corp., York, Pa.
Maysteel Products, Inc., Mayville, Wis.
•Rhoads & Sons, J. E., Philadelphia, Pa.
Rockwood Mfg. Co., Indianapolis, Ind.

BASES AND PADS, VIBRATION ISOLATING

•Armstrong Cork Co., Lancaster, Pa.
•Buffalo Forge Co., Buffalo, N. Y.
Butterworth, B. T., Jr., New Canaan, Conn.
•Clarage Fan Co., Kalamazoo, Mich.
Cork Import Corp., New York, N. Y.
Cork Insulation Co., Inc., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Felters Co., Inc., Boston, Mass.
Firestone Tire & Rubber Co., Akron, O.
Gates Rubber Co., Denver, Col.
Goodrich Co., B. F., Akron, O.
•Johns-Manville, New York, N. Y.
Keldur Corp., New York, N. Y.
Korfund Co., Long Island City, N. Y.
Lord Mfg. Co., Erie, Pa.
Manley Products Corp., York, Pa.
•Mundet Cork Corp., Brooklyn, N. Y.
National Lead Co., New York, N. Y.
United Cork Companies, Lyndhurst, N. J.
United States Rubber Co., New York, N. Y.
•Vibration Eliminator Co., Astoria, N. Y.
Western Felt Works, Chicago, Ill.

BEARINGS, BALL

Ahlberg Bearing Co., Chicago, Ill.
Bantam Bearings Corp., South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., Indianapolis, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
New Departure Div., General Motors Corp., Bristol, Conn.
Nice Ball Bearing Co., Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
•SKF Industries, Inc., Philadelphia, Pa.
Schatz Mfg. Co., Fairview, Poughkeepsie, N. Y.
Shafer Bearing Corp., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Torrington Co., The, Torrington, Conn.
Wood's Sons Co., T. B., Chambersburg, Pa.

BEARINGS, PILLOW BLOCK

Ahlberg Bearing Co., Chicago, Ill.
Air Controls, Inc., Cleveland, O.
Caldwell Co., W. E., Louisville, Ky.
Central Die Casting & Mfg. Co., Inc., Chicago, Ill.
Chain Belt Co., Milwaukee, Wis.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
General Motors Corp., Moraine Products Div., Dayton, O.
Goldens' Foundry & Machine Co., Columbus, Ga.
Jeffrey Mfg. Co., Columbus, O.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Lau Blower Co., Dayton, O.
Link-Belt Co., Indianapolis, Ind.
Medart Co., St. Louis, Mo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
•Randall Graphite Products Corp., Chicago, Ill.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
•SKF Industries, Inc., Philadelphia, Pa.
Shafer Bearing Corp., Chicago, Ill. (self aligning)
Smith, Inc., Winfield H., Springville, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Triangle Mfg. Co., Oshkosh, Wis.
Viking Air Conditioning Corp., Cleveland, O.
Wood's Sons Co., T. B., Chambersburg, Pa.

BEARINGS, ROLLER

Ahlberg Bearing Co., Chicago, Ill.
Bantam Bearings Corp., South Bend, Ind.
Dodge Mfg. Corp., Mishawaka, Ind.
Hyatt Bearings Div., General Motors Corp., Harrison, N. J.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Link-Belt Co., Indianapolis, Ind.
Medart Co., St. Louis, Mo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Trenton, N. J.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
•SKF Industries, Inc., Philadelphia, Pa.
Shafer Bearing Corp., Chicago, Ill. (self aligning)
Timken Roller Bearing Co., Canton, O.
Torrington Co., The, Torrington, Conn.
Wood's Sons Co., T. B., Chambersburg, Pa.

BEARINGS, SLEEVE

Dodge Mfg. Corp., Mishawaka, Ind.
Federal-Mogul Corp., Detroit, Mich.
General Motors Corp., Moraine Products Div., Dayton, O.

• Advertisement in this issue. See Index to Advertisers, page 306.

Johnson Bronze Co., New Castle, Pa.
Keystone Carbon Co., Inc., St. Marys, Pa.
Medart Co., St. Louis, Mo.
Motex Metal Process Corp., Detroit, Mich.
•Randall Graphite Products Corp., Chicago, Ill.
Wood's Sons Co., T. B., Chambersburg, Pa.

BELLOWS, THERMOSTATIC

Bishop & Babcock Mfg. Co., Cleveland, O.
Bridgeport Thermostat Co., Inc., Bridgeport, Conn.
Cashin Co., W. D., Boston, Mass.
•Clifford Mfg. Co., Boston, Mass.
Cook Electric Co., Chicago, Ill.
•Fulton Sylphon Co., Knoxville, Tenn.

BELTING, FLAT, LEATHER

Alexander Bros., Inc., Philadelphia, Pa.
Chicago Belting Co., Chicago, Ill.
Graton & Knight Co., Worcester, Mass.
Houghton & Co., E. F., Philadelphia, Pa.
•Rhoads & Sons, J. E., Philadelphia, Pa.
Schieren Co., Chas. A., New York, N. Y.
Williams & Son, I. B., Dover, N. H.

BELTING, FLAT, RUBBER

Boston Woven Hose & Rubber Co., Cambridge, Mass.
Continental Rubber Wks., Erie, Pa.
Dick Co., Inc., R. & J., Passaic, N. J.
Firestone Tire & Rubber Co., Akron, O.
Garlock Packing Co., Palmyra, N. Y.
Gilmer Co., L. H., Philadelphia, Pa.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Hamilton Rubber Mfg. Co., Trenton, N. J.
Jeffrey Mfg. Co., Columbus, O.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.
Quaker Rubber Corp., Philadelphia, Pa.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Rockwood Mfg. Co., Indianapolis, Ind.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
United States Rubber Co., New York, N. Y.

BELTS, V

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Chicago Belting Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
Firestone Tire & Rubber Co., Akron, O.
Gates Rubber Co., Denver, Colo.
Gilmer Co., L. H., Philadelphia, Pa.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Graton & Knight Co., Worcester, Mass.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.
Medart Co., St. Louis, Mo.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Rockwood Mfg. Co., Indianapolis, Ind.
Schieren Co., Chas. A., New York, N. Y.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
United States Rubber Co., New York, N. Y.
Wood's Sons Co., T. B., Chambersburg, Pa.
•Worthington Pump & Machinery Corp., Harrison, N. J.

BENDERS, PIPE

American Pipe Bending Machine Co., Inc., Boston, Mass.
American Pipe Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Bernz Co., Inc., Otto, Rochester, N. Y.
Blackhawk Mfg. Co., Milwaukee, Wis.
•Buffalo Forge Co., Buffalo, N. Y.
Crown Die & Tool Co., Chicago, Ill. (Hand)
Greenlee Tool Co., Rockford, Ill.
Holsclaw Bros., Inc., Evansville, Ind.
Hossfeld Mfg. Co., Winona, Minn.
•O'Neil Irwin Mfg. Co., Inc., Minneapolis, Minn.
Pedrick Tool & Machine Co., Philadelphia, Pa.
Tal's Prestal Bender, Inc., Milwaukee, Wis.
Toledo Pipe Threading Machine Co., Toledo, O.
Vanderman Mfg. Co., Willimantic, Conn.
Wallace Supplies Mfg. Co., Chicago, Ill.
•Watson-Stillman Co., Roselle, N. J.

BENDERS, TUBING

American Pipe Bending Machine Co., Inc., Boston, Mass.
Armstrong Mfg. Co., Bridgeport, Conn.
Bernz Co., Inc., Otto, Rochester, N. Y.
•Buffalo Forge Co., Buffalo, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
Greenlee Tool Co., Rockford, Ill.
Hays Mfg. Co., Erie, Pa. (Copper Tube)
Holsclaw Bros., Inc., Evansville, Ind.
Hossfeld Mfg. Co., Winona, Minn.
Imperial Brass Mfg. Co., Chicago, Ill.
Martin & Sons, H. P., Owensboro, Ky.
•O'Neil Irwin Mfg. Co., Inc., Minneapolis, Minn.
Parker Appliance Co., Cleveland, O.
Pedrick Tool & Machine Co., Philadelphia, Pa.
Perfection Refrigeration Parts Co., Harvey, Ill.
Sac Tool Mfg. Co., St. Louis, Mo.
Snap-On Tools Corp., Kenosha, Wis.
Wallace Supplies Mfg. Co., Chicago, Ill.
•Watson-Stillman Co., Roselle, N. J.

BENDS, EXPANSION, STEAM PIPE

American Locomotive Co., Alco Products Div., New York, N. Y.
•Crane Co., Chicago, Ill.
•Flori Pipe Co., The, St. Louis, Mo.
•Grinnell Co., Inc., Providence, R. I.
Harris & Co., Arthur, Chicago, Ill. (Stainless & non-ferrous)
Harrisburg Steel Corp., Harrisburg, Pa.
Kellogg Co., M. W., The, New York, N. Y. (Corrugated steel)
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden & Van Stone Co., South Boston, Mass.
Metal Products Fabricating Co., San Francisco, Cal.
•Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
National Valve & Mfg. Co., Pittsburgh, Pa.
Ohio Pipe Bending & Machine Co., Cleveland, O.
Parks-Cramer Co., Fitchburg, Mass.
Pittsburgh Pipe Coil & Bending Co., Etna, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
Rempe Co., Chicago, Ill.
•Ric-wiL Co., Cleveland, O.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Shaw Co., Benjamin F., Wilmington, Del.
Shaw-Kendall Engineering Co., Toledo, O.
Walworth Co., New York, N. Y.

BI-METALS, THERMOSTATIC

Chace Co., W. M., Detroit, Mich.
General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Wilson Co., H. A., The, Newark, N. J.

BLADES, PROPELLER FAN

Ackermann Mfg. Co., Wheeling, W. Va.
Aerovent Fan Co., Piqua, O.
Air Controls, Inc., Cleveland, O.
Aire-Foile Fan & Blower Co., Detroit, Mich.
Airmaster Corp., Chicago, Ill.
Allen Corp., Detroit, Mich.
Belanger Fan & Blower Co., Detroit, Mich.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., Irvington, N. J.
Circulators & Devices Mfg. Corp., New York, N. Y.
Dallas Engineering Co., Inc., Dallas, Tex.
DeBothezat Ventilating Equipment Div., American Machine & Metals, Inc., East Moline, Ill.
Dual Air Fan Co., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
General Aire Co., Philadelphia, Pa.
International Engrg., Inc., Dayton, O.
Lohman Co., Wm. J., Irvington, N. J.
Meier Electric & Machine Co., Indianapolis, Ind.
Myers Electric Co., Inc., Pittsburgh, Pa.
Norwin Co., Freeport, Ill.
Peerless Electric Co., Warren, O.
Schwitzer-Cummins Co., Indianapolis, Ind.
South Bend Air Products Corp., South Bend, Ind.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Swift Mfg. Co., Detroit, Mich.
•Torrington Mfg. Co., Torrington, Conn.
Utility Fan Corp., Los Angeles, Cal.
Victor Electric Products, Inc., Cincinnati, O.

BLAST GATES

See Gates, Blast

BLAST HEATERS

See Surface, Heating

BLAST HEATING COILS

See Surface, Heating

• Advertisement in this issue. See Index to Advertisers, page 306.

BLINDS, VENETIAN

Athey Co., Chicago, Ill.
Bostwick-Goodell Co., Norwalk, O. (Shutter awnings)
Chicago Venetian Blind Co., Chicago, Ill.
Columbia Mills, Inc., Saginaw, Mich.
Higgin Products, Inc., Newport, Ky.
Hough Shade Corp., Janesville, Wis.
Kane Mfg. Corp., Kane, Pa.
Miller & Connell Co., Chicago, Ill.
Mitchell Moulding Co., Forest Park, Ill.
Patterson Shade Co., Indianapolis, Ind.
Russell Co., F. C., Cleveland, O.
Snead, Herbert S., New York, N. Y.
Standard Products Co., Detroit, Mich.
Swedish Venetian Blind Co., New York, N. Y.
Warren Shade Co., Inc., Minneapolis, Minn.
Yardley Screen & Weather Strip Co., Columbus, O.

BLOW PIPE FITTINGS

See Fittings, Blow Pipe

BLOWER FANS

See Fans, Centrifugal

BLOWER WHEELS

See Wheels, Blower

BLOWERS, HIGH PRESSURE

For Low Pressure Blower Fans, See Fans, Centrifugal

Allen Billmyre Corp., Mamaroneck, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Corp., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Beach-Russ Co., New York, N. Y.
●Buffalo Forge Co., Buffalo, N. Y.
Carling Turbine Blower Co., Worcester, Mass.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., Irvington, N. J.
Circulators & Devices Mfg. Corp., New York, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
Garden City Fan Co., Chicago, Ill.
Ingersoll-Rand Co., New York, N. Y.
Lammert & Mann Co., Chicago, Ill.
Muncie Gear Wks., Muncie, Ind.
National Machine Works, Chicago, Ill.
North American Mfg. Co., Cleveland, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Spencer Turbine Co., Hartford, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Trimount Rotary Power Co., East Bedham, Mass.
Utility Fan Corp., Los Angeles, Cal.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.

BLOWERS, SOOT

Bayer Co., St. Louis, Mo.
Diamond Power Specialty Corp., Detroit, Mich.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Marion Machine Foundry & Supply Co., Marion, Ind.
Perfection Grate & Stoker Co., Springfield, Mass.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

BLOW-OFF VALVES

See Valves, Blow-Off

BLUE PRINT MACHINES

See Machines, Blue Print and White Print

BOILER CLEANING COMPOUNDS

See Compounds, Boiler Cleaning

BOILER FEED PUMPS

See Pumps, Boiler Feed

BOILER FEEDERS

See Feeders, Water, Heating Boiler

BOILER OBSERVATION PORTS

See Ports, Observation, Boiler

BOILER SEALING COMPOUNDS

See Compounds, Boiler and Radiator Sealing

BOILER AND TANK INSULATION

See Insulation, Boiler and Tank

BOILER TUBES

See Tubes, Boiler

BOILER WATER ALARMS

See Alarms, High and Low Boiler Water

BOILERS, HEATING, CAST IRON, SECTIONAL

2000 Sq Ft Steam Radiation and Over

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Bryan Steam Corp., Peru, Ind.
Bryant Heater Co., The, Cleveland, O.
●Burnham Boiler Corp., Irvington, N. Y.
Columbia Radiator Co., McKeesport, Pa.
●Crane Co., Chicago, Ill.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Herbert Boiler Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Kohler Co., Kohler, Wis.
National Radiator Co., The, Johnstown, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
●Smith Co., Inc., H. B., The, Westfield, Mass.
Spencer Heater Div., The Aviation Corp., Williamsport, Pa.
Thatcher Furnace Co., Garwood, N. J.
United States Radiator Corp., Detroit, Mich.
Weil-McLain Co., Chicago, Ill.

BOILERS, HEATING, STEEL, FIRE TUBE

2000 Sq Ft Steam Radiation and Over

Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.
Atlantic Steel Boiler Co., Philadelphia, Pa.
Bass Foundry & Machine Co., Ft. Wayne, Ind.
Bigelow Co., New Haven, Conn.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
●Burnham Boiler Corp., Irvington, N. Y.
Cleaver-Brooks Co., Milwaukee, Wis.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., New York, N. Y.
Dillon Steam Boiler Wks., Inc., D. M., Fitchburg, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Erie City Iron Wks., Erie, Pa.
Farrar & Trefts, Buffalo, N. Y.
●Fitzgibbons Boiler Co., Inc., New York, N. Y.
Frost Mfg. Co., Galesburg, Ill.
Gallaher Boiler Co., St. Louis, Mo.
General Furnaces Corp., New York, N. Y.
Hodge Boiler Wks., East Boston, Mass.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Inc., Framingham, Mass.
Johnston Bros., Inc., Ferrysburg, Mich.
Keeler Co., Williamsport, Pa.
●Kewanee Boiler Corp., Kewanee, Ill.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Leffel & Co., Springfield, O.
Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
Manitowoc Boiler Wks., Manitowoc, Wis.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa. (For process steam supply only)
Murray Iron Wks. Co., Burlington, Ia.
National Radiator Co., The, Johnstown, Pa.
Oil City Tank & Boiler Co., Oil City, Pa.
Orr & Sembower, Inc., Reading, Pa.
Pacific Steel Boiler Div., United States Radiator Corp., Detroit, Mich.
Sellers Engineering Co., Chicago, Ill.
Smith Twin Tubular Boiler Co., Inc., Philadelphia, Pa.
Spencer Heater Div., The Aviation Corp., Williamsport, Pa.
Titusville Iron Wks. Co., Titusville, Pa.
Union Iron Wks., Erie, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Vortex Mfg. Co., Portland, Ore.
Wickes Boiler Co., Saginaw, Mich.

BOILERS, HEATING, STEEL, WATER TUBE

Anetsberger Bros., Chicago, Ill.
Atlantic Steel Boiler Co., Philadelphia, Pa.
Babcock & Wilcox Co., New York, N. Y.
Bass Foundry & Machine Co., Ft. Wayne, Ind.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Bryan Steam Corp., Peru, Ind.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., New York, N. Y.
Edge Moor Iron Wks., Inc., New York, N. Y.
Erie City Iron Wks., Erie, Pa.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Inc., Framingham, Mass.
Keeler Co., E., Williamsport, Pa.
Koven & Bro., Inc., L. O., Jersey City, N. J.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa. (For process steam supply only)
Murray Iron Wks. Co., Burlington, Ia.
Oil City Tank & Boiler Co., Oil City, Pa.
Orr & Sembower, Inc., Reading, Pa.

● Advertisement in this issue. See Index to Advertisers, page 306.

Riley Stoker Corp., Worcester, Mass.
Smith Twin Tubular Boiler Co., Inc., Philadelphia Pa.
Spencer Heater Div., The Aviation Corp., Williamsport, Pa.
Super Mold Corp., Lodi, Cal.
Titusville Iron Wks. Co., Titusville, Pa.
Union Iron Works, Erie, Pa.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
Waterfilm Boilers, Inc., Jersey City, N. J.
Wickes Boiler Co., Saginaw, Mich.

BOLTS, EXPANSION

Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Fee & Mason Mg. Co., Inc., New York, N. Y.
National Lead Co., New York, N. Y.
Ohio Brass Co., Mansfield, O.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., The, New York, N. Y.
Rolyan Corp., Chicago, Ill.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Star Expansion Bolt Co., New York, N. Y.
U. S. Expansion Bolt Co., York, Pa.

BOLTS AND STUDS, FLANGE

Bethlehem Steel Co., Bethlehem, Pa.
Black-Sivalls & Bryson, Inc., Kansas City, Mo.
Chase Brass & Copper Co., Waterbury, Conn.
Clark Bros. Bolt Co., Milldale, Conn.
●Crane Co., Chicago, Ill.
Erie Bolt & Nut Co., Erie, Pa.
Haskell Mfg. Co., Wm. H., Pawtucket, R. I.
Lamson & Sessions Co., Cleveland, O.
Maintenance Engineering Corp., Houston, Texas
Republic Steel Corp., Bolt & Nut Div., Cleveland, O.
Rolyan Corp., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y
Ryerson & Son, Inc., Jos. T., Chicago, Ill.

BOLTS, TOGGLE AND ANCHOR

Carty & Moore Engineering Co., Detroit, Mich.
Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
Grabler Mfg. Co., Cleveland, O.
Lamson & Sessions Co., Cleveland, O.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., The, New York, N. Y.
Republic Steel Corp., Cleveland, O.
Rolyan Corp., Chicago, Ill.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Star Expansion Bolt Co., New York, N. Y.
U. S. Expansion Bolt Co., York, Pa.

BOOTHS, PAINTING, SPRAY

Aqua-Restor Div., Mayer Mfg. Corp., Brooklyn, N. Y.
Belanger Fan & Blower Co., Detroit, Mich.
Binks Mfg. Co., Chicago, Ill.
DeVilbiss Co., The, Toledo, O.
Goethel Sheet Metal Works, Alfred, Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Industrial Sheet Metal Works, Inc., Detroit, Mich.
Kirk & Blum Mfg. Co., Cincinnati, O.
Mahon Co., R. C., Detroit, Mich.
Northern Blower Co., Cleveland, O.
Schmieg Sheet Metal Works, Detroit, Mich.
Spray Engineering Co., Somerville, Mass.
Young & Bertke Co., Cincinnati, O.

BRAKES, SHEET METAL, HAND

Dreis & Krump Mfg. Co., Chicago, Ill.
Eiker Mfg. Co., Ogallala, Nebr.
Excelsior Tool & Machine Co., East St. Louis, Ill.
New Albany Machine Mfg. Co., New Albany, Ind.
Niagara Machine & Tool Works, Buffalo, N. Y.
●O'Neil Irwin Mfg. Co., Inc., Minneapolis, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Weiss & Co., H., New York, N. Y.
Whitney Metal Tool Co., Rockford, Ill.

BRAKES, SHEET METAL, PORTABLE

Dreis & Krump Mfg. Co., Chicago, Ill.
Eiker Mfg. Co., Ogallala, Nebr.
Harris, A. R., Hammond, Ind.
●O'Neil Irwin Mfg. Co., Inc., Minneapolis, Minn.
Whitney Metal Tool Co., Rockford, Ill.

BRAKES, SHEET METAL, POWER

Cincinnati Shaper Co., Cincinnati, O.
Dreis & Krump Mfg. Co., Chicago, Ill.
Heartley Machine & Tool Co., Toledo, O.
Ohl & Co., Geo. A., Newark, N. J.
Peck, Stow & Wilcox Co., Southington, Conn.
Rafter Machine Co., Belleville, N. J.
Swaine Mfg. Co., Fred J., St. Louis, Mo.
Verson Allsteel Press Co., Chicago, Ill.
Weiss & Co., H., New York, N. Y.
Whitney Metal Tool Co., Rockford, Ill.

BRASS PIPE

See Pipe, Brass and Copper

BRASS TUBING

See Tubing, Brass and Copper

BRASS UNIONS

See Unions, Brass

BRASS VALVES

See Valves, Gate; and Valves, Globe

BRAZING TORCHES

See Torches, Brazing

BRONZE VALVES

See Valves, Gate; and Valves, Globe

BUILDING INSULATION

See Insulation, Building

BURNERS, GAS, COMMERCIAL AND INDUSTRIAL

Barber Gas Burner Co., Cleveland, O.
Beck Engineering Combustion Kompany, St. Louis, Mo.
Bryant Heater Co., The, Cleveland, O.
Campbell Heating Co., E. K., Kansas City, Mo.
Conco Corp., Div. of H. D. Conkey & Co., Mendota, Ill.
Continental Stove Corp., Ironton, O.
Coppus Engineering Corp., Worcester, Mass.
Eclipse Fuel Engrg. Co., Rockford, Ill.
Engineer Co., New York, N. Y.
Enterprise Engine & Foundry Co., San Francisco, Cal.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Hugo Mfg. Co., West Duluth, Minn.
Jamieson Mfg. Co., Dallas, Tex.
Johnson Gas Appliance Co., Cedar Rapids, Ia.
Lammert & Mann Co., Chicago, Ill.
Martin, J. O. & C. U., San Francisco, Cal.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Mettler Co., Lee B., Los Angeles, Cal.
National Airoil Burner Co., Inc., Philadelphia, Pa.
National Machine Wks., Chicago, Ill.
North American Mfg. Co., Cleveland, O.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Peabody Engrg. Corp., New York, N. Y.
●R-S Products Corp., Philadelphia, Pa.
Ray Oil Burner Co., San Francisco, Cal.
●Reznor Mfg. Co., Mercer, Pa.
Roberts-Gordon Appliance Corp., Buffalo, N. Y.
Rotary Mfg. Co., Los Angeles, Cal.
Schutte & Koerting Co., Philadelphia, Pa.
Selas Co., The, Philadelphia, Pa.
Sellers Engineering Co., Chicago, Ill.
Sonner Burner Co., Winfield, Kans.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Sullivan Valve & Engineering Co., Butte, Mont.
Surface Combustion, Toledo, O.
●Todd Combustion Equipment, Inc., New York, N. Y.
●Webster Engineering Co., Tulsa, Okla.
Williams, Inc., F. C., Dearborn, Mich.
●Zink Co., John, Tulsa, Okla.

BURNERS, GAS AND OIL COMBINED, COMMERCIAL AND INDUSTRIAL

Babcock & Wilcox Co., New York, N. Y.
Coppus Engineering Corp., Worcester, Mass.
Engineer Co., New York, N. Y.
Enterprise Engine & Foundry Co., San Francisco, Cal.
Johnson Co., S. T., Oakland, Cal.
Mettler Co., Lee B., Los Angeles, Cal.
National Airoil Burner Co., Inc., Philadelphia, Pa.
Peabody Engineering Corp., New York, N. Y.
●R-S Products Corp., Philadelphia, Pa.
Ray Oil Burner Co., San Francisco, Cal.
Sellers Engineering Co., Chicago, Ill.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Surface Combustion, Toledo, O.
●Todd Combustion Equipment, Inc., New York, N. Y.
●Webster Engineering Co., Tulsa, Okla.
●Zink Co., John, Tulsa, Okla.

● Advertisement in this issue. See Index to Advertisers, page 306.

BURNERS, OIL, COMMERCIAL AND INDUSTRIAL

Airtemp, Div. of Chrysler Corp., Dayton, O.
Babcock & Wilcox Co., New York, N. Y.
Bethlehem Foundry & Machine Co., Bethlehem, Pa.
Caloroil Burner Corp., Hartford, Conn.
Century Engrg. Corp., Cedar Rapids, Ia.
Chandler Co., Cedar Rapids, Ia.
Chisholm Co., Allen E., Portland, Ore.
Combustion Engineering Co., Inc., New York, N. Y.
Conco Corp., Div. of H. D. Conkey & Co., Mendota, Ill.
Eastern Oil & Equipment Co., Inc., Portland, Me.
Electrol, Inc., Clifton, N. J.
Engineering Co., New York, N. Y.
Enterprise Engine & Foundry Co., San Francisco, Cal.
Hardinge Mfg. & Oil Burner Co., Chicago, Ill.
Harvey-Whipple, Inc., Springfield, Mass.
Holtum Mfg. Co., Freeport, Ill.
Johnson Co., S. T., Oakland, Cal.
Johnson Mfg. Co., Waterloo, Ia.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Lammert & Mann Co., Chicago, Ill.
Littleford Bros., Cincinnati, O.
●May Oil Burner Corp., Baltimore, Md.
Mettler Co., Lee B., Los Angeles, Cal.
Montag Stove & Furnace Works, Portland, Ore.
National Airoil Burner Co., Inc., Philadelpia, Pa.
North American Mfg. Co., Cleveland, O.
Nu-Way Corp., Rock Island, Ill.
Pan-American Engineering Co., Berkeley, Cal.
Peabody Engrg. Corp., New York, N. Y.
●Petroleum Heat & Power Co., Stamford, Conn.
Preferred Utilities Mfg. Corp., New York, N. Y.
Quiet Heet Mfg. Co., Newark, N. J.
●R-S Products Corp., Philadelphia, Pa.
Ray Oil Burner Co., San Francisco, Cal.
Reif-Rexoil, Inc., Buffalo, N. Y.
Riley Stoker Corp., Worcester, Mass.
Rotary Mfg. Co., Los Angeles, Cal.
Schutte & Koerting Co., Philadelphia, Pa.
Scott-Newcomb, Inc., St. Louis, Mo.
Simplex Oil Heating Corp., Newark, N. J.
Stainless & Steel Products Co., St. Paul, Minn.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
●Todd Combustion Equipment, Inc., Brooklyn, N. Y.
Vortex Mfg. Co., Portland, Ore.
Wayne Oil Burner Co., Fort Wayne, Ind.
●Webster Engineering Co., Tulsa, Okla.
Williams, Inc., F. C., Dearborn, Mich.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
York Oil Burner Co., Inc., York, Pa.
●Zink Co., John, Tulsa, Okla.

CARBON DIOXIDE ANALYZERS

See Analyzers, Carbon Dioxide, Portable

CARBON DIOXIDE INDICATORS

See Indicators, Carbon Dioxide, Boiler Room

CARBON PIPE, TUBING, FITTINGS AND VALVES

See Pipe, Tubing, Fittings and Valves, Carbon

CAST IRON PIPE

See Pipe, Cast Iron

CEMENT AND COMPOUNDS, PIPE JOINT

Acme Refining Co., The, Cleveland, O
Acorn Refining Co., Cleveland, O.
Aeco Packing Products Co., Chicago, Ill.
Akron Metallic Gasket Co., Akron, O.
Atlas Chemical Co., Marietta, O.
Baer Bros., New York, N. Y.
Barber Asphalt Corp., Barber, N. J.
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Black Magic Products Co., Tulsa, Okla.
Blue Seal Chemical Co., Roselle Park, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Calbar Paint & Varnish Co., Philadelphia, Pa.
Clinton Metallic Paint Co., Clinton, N. Y.
Colebrook & Sons, Inc., W. H., Syracuse, N. Y.
Continental Products Co., Euclid, O.
Cooper Sanitary Co., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Crane Packing Co., Chicago, Ill.
Croll & Son, Jesse G., Philadelphia, Pa.
Detroit Graphite Co., Detroit, Mich.
Dixon Crucible Co., Joseph, Jersey City, N. J.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Greene, Tweed & Co., New York, N. Y.
●Grinnell Co., Inc., Providence, R. I.
Hercules Chemical Co., Inc., New York, N. Y.
Hetzel Roofing Products Co., Newark, N. J.
Horn Co., A. C., Long Island City, N. Y.
Key Co., East St. Louis, Ill.
Keystone Asphalt Products Co., Chicago, Ill.
Krehbiel Co., J. H., Chicago, Ill.
Mackson's Co., New York, N. Y.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
Montgomery Bros., San Francisco, Cal.
National Engineering Products, Inc., Washington, D. C.
Nebel Mfg. Co., Cleveland, O.
Permatex Co., Inc., Sheepshead Bay, N. Y.
Preferred Utilities Mfg. Corp., New York, N. Y.
Pyrolite Products Co., Cleveland, O.
Radiator Specialty Co., Charlotte, N. C.
Reilly Tar & Chemical Corp., Indianapolis, Ind.
Rockwood Sprinkler Co., Worcester, Mass.
●Rutland Fire Clay Co., Rutland, Vt.
Sauereisen Cements Co., Sharpsburg, Pa.
Schundler & Co., F. E., Long Island City, N. Y.
Smooth-On Mfg. Co., Jersey City, N. J.
Star Products Co., New York, N. Y.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Thompson & Co., Pittsburgh, Pa.
United States Stoneware Co., New York, N. Y.
Utility Laboratory, Inc., Brooklyn, N. Y.
Wilhelm Co., A., Reading, Pa.
X Laboratories, Inc., New York, N. Y.
●X-Pando Corp., Long Island City, N. Y.

CEMENT, FURNACE

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Armstrong Co., Detroit, Mich.
Buckeye Products Co., Cincinnati, O.
●Carey Mfg. Co., Philip, Lockland, Cincinnati, O.
Clinton Metallic Paint Co., Clinton, N. Y. (Asbestos)
Colebrook & Sons, Inc., W. H., Syracuse, N. Y.
Continental Products Co., Euclid, O.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Fireline Stove & Furnace Lining Co., Chicago, Ill.
●Grant Wilson, Inc., Chicago, Ill. (Asbestos)
Green Fire Brick Co., A. P., Mexico, Mo.
Hercules Chemical Co., Inc., New York, N. Y.
Hetzel Roofing Products Co., Newark, N. J.
●Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y. (Asbestos)
Krehbiel Co., J. H., Chicago, Ill.
Laclede-Christy Clay Products Co., St. Louis, Mo.
Lastik Products Co., Inc., Pittsburgh, Pa.
McLeod & Henry Co., Inc., Troy, N. Y.
Munn and Steele, Inc., Newark, N. J.
Nebel Mfg. Co., Cleveland, O.
Pecora Paint Co., Philadelphia, Pa.
Plastic Products Co., Detroit, Mich.
Preferred Utilities Mfg. Corp., New York, N. Y.
Presstite Engineering Co., St. Louis, Mo.
Pyrolite Products Co., Cleveland, O.
Quigley Co., Inc., New York, N. Y.
Refractory & Insulation Corp., New York, N. Y.
Robinson Insulation Co., Great Falls, Mont.
Ruberoid Co., New York, N. Y.
●Rutland Fire Clay Co., Rutland, Vt.
●Sall Mountain Co., Chicago, Ill.
Sauereisen Cements Co., Sharpsburg, Pa.
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Fuel Engineering Co., Detroit, Mich.
United States Stoneware Co., New York, N. Y.
Walsh Refractories Corp., St. Louis, Mo.
Wilhelm Co., A., Reading, Pa.
●Wilson, Grant, Inc., Chicago, Ill. (Asbestos)

CEMENT, INSULATING

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Bird-Archer Co., Philadelphia, Pa.
Botfield Refractories Co., Philadelphia, Pa.
●Carey Mfg. Co., Philip, Lockland, Cincinnati, O.
Carney Rockwool Co., Mankato, Minn.
Chicago Fire Brick Co., Chicago, Ill.
Clinton Metallic Paint Co., Clinton, N. Y.
Colebrook & Sons, Inc., W. H., Syracuse, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
●Grant Wilson, Inc., Chicago, Ill.
Green Fire Brick Co., A. P., Mexico, Mo.
Industrial Research, Lansdowne, Pa.
International Vermiculite Co., Springfield, Ill.
●Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Krehbiel Co., J. H., Chicago, Ill. (Asbestos, mineral wool)
McLeod & Henry Co., Inc., Troy, N. Y.
●Mitchell & Smith, Inc., Detroit, Mich.
Munn and Steele, Inc., Newark, N. J.
National Engineering Products, Inc., Washington, D. C.
National Gypsum Co., Buffalo, N. Y.
Nelson Mfg. Co., B. F., Minneapolis, Minn.
Norristown Magnesia & Asbestos Co., Norristown, Pa.
Ohmlac Paint & Refining Co., Chicago, Ill
●Owens-Corning Fiberglas Corp., Toledo, O.

● Advertisement in this issue. See Index to Advertisers, page 306.

Plant Rubber & Asbestos Works, San Francisco, Cal.
Poe Co., C. W., Cleveland, O.
Preferred Utilities Mfg. Corp., New York, N. Y.
Pyrolite Products Co., Cleveland, O.
Quigley Co., Inc., New York, N. Y.
Ramtite Co., The, Chicago, Ill.
Refractory & Insulation Corp., New York, N. Y.
Rex Clay Products Co., Detroit, Mich.
Robinson Insulation Co., Great Falls, Mont.
Ruberoid Co., New York, N. Y.
●Rutland Fire Clay Co., Rutland, Vt.
●Sall Mountain Co., Chicago, Ill.
Sauereisen Cements Co., Sharpsburg, Pa.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler Corp., Elizabeth, N. J.
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Fuel Engineering Co., Detroit, Mich.
Tennessee Products Corp., Nashville, Tenn.
Therminsul Corp., Kalamazoo, Mich.
Thompson & Co., Pittsburgh, Pa.
United States Gypsum Co., Chicago, Ill.
United States Mineral Wool Co., Chicago, Ill.
Universal Zonolite Insulation Co., Chicago, Ill.
●Wilson, Inc., Grant, Chicago, Ill.

CENTRIFUGAL PUMPS

See Pumps, Centrifugai

CHAIN DRIVES

See Drives, Chain

CHANGERS, SPEED, HYDRAULIC COUPLING

American Blower Corp., Detroit, Mich.
●U. S. Air Conditioning Corp., Minneapolis, Minn.

CHANGERS, SPEED, MECHANICAL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Dodge Mfg. Corp., Mishawaka, Ind.
Graham Transmissions, Inc., Milwaukee, Wis.
Ideal Commutator Dresser Co., Sycamore, Ill.
Lewellen Mfg. Co., Columbus, Ind.
Link-Belt Co., Philadelphia, Pa.
Reeves Pulley Co., Columbus, Ind.
Speedmaster Co., The, Des Plaines, Ill.
Standard Transmission Equipment Co., Los Angeles, Cal.
Stephens-Adamson Mfg. Co., Aurora, Ill.
White Mfg. Co., St. Paul, Minn.

CHECK VALVES

See Valves, Check

CHILLERS, WATER, FOR AIR CONDITIONING AND REFRIGERATION

●Acme Industries, Inc., Jackson, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
●Bell & Gossett Co., Morton Grove, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Downingtown Iron Works, Downingtown, Pa.
Drayer & Hanson, Inc., Los Angeles, Cal.
Filtrine Mfg. Co., Brooklyn, N. Y.
Frick Co., Waynesboro, Pa.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
Griscom-Russell Co., The, New York, N. Y.
Heat Transfer Products, Inc., New York, N. Y.
Howe Ice Machine Co., Chicago, Ill.
●McQuay, Inc., Minneapolis, Minn.
Mojonnier Bros. Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Refrigeration Economics Co., Inc., Canton, O.
Richmond Engineering Co., Inc., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Temprite Products Corp., Detroit, Mich.
●Trane Co., The, La Crosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
●Whitlock Mfg. Co., Hartford, Conn.
●Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J.
XL Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.

CIRCULATORS FOR HOT WATER HEATING SYSTEMS

American-Marsh Pumps, Inc., Battle Creek, Mich.
●Bell & Gossett Co., Morton Grove, Ill.
Columbus Steam Pump Works Co., Columbus, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
●Hoffman Specialty Co., Indianapolis, Ind.
Hotstream Heater Co., Cleveland, O.
Ingersoll-Rand, New York, N. Y.
Kainer & Co., Chicago, Ill.
Kehm Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn
Mojonnier Brothers Co., Chicago, Ill.
Penberthy Injector Co., Detroit, Mich.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
●Trane Co., The, La Crosse, Wis.
Triplex Heating Specialty Co., Peru, Ind.
White Flo-Matic Corp., Hoosick Falls, N. Y.

CLAMPS, BEAM, PIPE HANGING

Acme Tin Plate & Roofing Supply Co., Philadelphia, Pa.
Carpenter & Paterson, Inc., East Boston, Mass.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Farley Sleeve & Hanger Co., Cleveland, O.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
●Flori Pipe Co., The, St. Louis, Mo.
Frick Co., Waynesboro, Pa.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Jarecki Mfg. Co., Erie, Pa.
National Valve & Mfg. Co., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
Walworth Co., New York, N. Y.

CLAMPS, PIPE REPAIR

Alten's Foundry & Machine Works, Lancaster, O.
Chelsea Metal Stamping Co., New York, N. Y.
Dresser Mfg. Co., Bradford, Pa.
Inner-Tite Clamp Corp., Elizabeth, N. J.
Jarecki Mfg. Co., Erie, Pa.
Skinner Co., M. B., South Bend, Ind.
Smooth-On Mfg. Co., Jersey City, N. J.
●Yarnall-Waring Co., Philadelphia, Pa.

CLAMPS, PIPE, WELDING

●Detroit Stamping Co., Detroit, Mich.
●Jewel Mfg. Co., St. Paul, Minn.

CLEANERS, AIR, ELECTRICAL

●American Air Filter Co., Inc., Louisville, Ky.
●Westinghouse Electric & Mfg. Co., Cleveland, O.

CLEANERS, TUBE

Albright Equipment Co., Johnstown, Pa.
Armstrong Mfg. Co., Bridgeport, Conn.
Elliott Co., Jeannette, Pa.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Mall Tool Co., Chicago, Ill.
Perfection Grate & Stoker Co., Springfield, Mass.
Pierce Co., Wm. B., The, Buffalo, N. Y.
Pilley Brush Co., Fort Madison, Ia.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Spencer Turbine Co., Hartford, Conn.

CLEANING COMPOUNDS

See Compounds, Cleaning, Pipe Coil and Condenser

COATINGS, PROTECTIVE, FOR METALS

Alrose Chemical Co., Providence, R. I.
American Solder & Flux Co., Philadelphia, Pa. (Galvanizing powder)
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Dampney Co. of America, Boston, Mass.
Dearborn Chemical Co , Chicago, Ill. (rust preventive)
Debevoise Co., The, Brooklyn, N. Y. (cement)
Flintkote Co., The, New York, N. Y. (Asphalt emulsions)
Haering Co., Inc., D. W., Chicago, Ill. (drying and non-drying)
Laclede-Christy Clay Products Co., St. Louis, Mo. (high temperature paint)
Nebel Mfg. Co., Cleveland, O.
Nelson Mfg. Co., B. F., Minneapolis, Minn.
Ohmlac Paint & Refining Co., Chicago, Ill. (acid resistant, heat resistant)
Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Pyrolite Products Co., Cleveland, O.
Quigley Co., Inc., New York, N. Y.
Reilly Tar & Chemical Corp., Indianapolis, Ind, (coal tar base)
●Ric-wiL Co., Cleveland, O.
Sonneborn Sons, Inc., L., New York, N. Y.
United States Stoneware Co., New York, N. Y. (Corrosion resistant)
Wailes Dove-Hermiston Corp., Westfield, N. J. (coal tar industrial pigmented)
Wipe-On Corp., New York, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 306.

COCKS, BOILER GAGE

American Injector Co., Detroit, Mich.
•Crane Co., Chicago, Ill.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

COILS

See Surface, Cooling; Surface, Heating

COILS, FOR HOT WATER STORAGE TANKS

•American District Steam Co., North Tonawanda, N. Y.
•Bell & Gossett Co., Morton Grove, Ill.
Kopperman & Sons, Joseph, Philadelphia, Pa.
National Pipe Bending Co., New Haven, Conn.
•Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Standard Heater & Oil Equipment Co., Jersey City, N. J
Taco Heaters, Inc., New York, N. Y.

COILS, PIPE

•Acme Industries, Inc., Jackson, Mich.
•American Smelting & Refining Co., New York, N. Y.
•Baker Ice Machine Co., Inc., Omaha, Nebr.
•Crane Co., Chicago, Ill.
Downingtown Iron Works, Downingtown, Pa.
Frick Co., Waynesboro, Pa.
Harris & Co., Arthur, Chicago, Ill.
Kopperman & Sons, Joseph, Philadelphia, Pa.
•Marlo Coil Co., St. Louis, Mo.
•Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
Ohio Pipe Bending & Machine Co., Cleveland, O.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
Standard Heater & Oil Equipment Co., Jersey City, N. J.
Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.

COLLECTORS, DUST

Aget-Detroit Mfg. Co., Detroit, Mich.
Allen Billmyre Corp., Mamaroneck, N. Y.
Allington & Curtis Mfg. Co., Saginaw, Mich.
•American Air Filter Co., Louisville, Ky.
American Blower Corp., Detroit, Mich.
American Foundry Equipment Co., Mishawaka, Ind.
American Metal Products Co., Fort Worth, Tex.
Aqua-Restor Div., Mayer Mfg. Corp., Brooklyn, N. Y.
Bayley Blower Co., Milwaukee, Wis.
Blower Application Co., Milwaukee, Wis.
Bubar, Hudson H., New York, N. Y.
•Buffalo Forge Co., Buffalo, N. Y.
Clark Dust Control Co., Chicago, Ill.
Day Co., The, Minneapolis, Minn.
Diamond Power Specialty Corp., Detroit, Mich.
Dracco Corp., Cleveland, O.
Faraday Engineering Co., Boston, Mass.
Garden City Fan Co., Chicago, Ill.
Goethel Co., Alfred C., Milwaukee, Wis.
Goethel Sheet Metal Wks., Alfred, Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Industrial Sheet Metal Wks., Inc., Detroit, Mich.
Jacobs Co., B. & J., Cincinnati, O.
Kirk & Blum Mfg. Co., Cincinnati, O.
Kluegel & Co., E., St. Paul, Minn.
Knickerbocker Co., Jackson, Mich.
Kopperman & Sons, Joseph, Philadelphia, Pa.
Martin Metal Mfg. Co., Wichita, Kan.
•New York Blower Co., Chicago, Ill.
Northern Blower Co., Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Prat-Daniel Corp., Port Chester, N. Y.
Puhl & Hepper Mfg. Co., Inc., St. Louis, Mo.
Research Corp., New York, N. Y.
Ruemelin Mfg. Co., Milwaukee, Wis.
Schmieg Sheet Metal Works, Detroit, Mich.
Schneible Co., Claude B., Chicago, Ill.
•Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Sly Mfg. Co., W. W., Cleveland, O.
Spencer Turbine Co., Hartford, Conn.
Steamaire Co., Cincinnati, O.
Steinhorst & Sons, Inc., Emil, Utica, N. Y.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Torit Mfg. Co., St. Paul, Minn.
Western Blower Co., Seattle, Wash.
Western Precipitation Corp., Los Angeles, Cal.
Young & Bertke Co., Cincinnati, O.

COMBUSTION CONTROL

See Controls, Draft, Barometric; Regulators, Draft, Combustion; Systems, Combustion Control

COMBUSTION RECORDERS

See Recorders, Carbon Dioxide

COMPOUNDS, BOILER CLEANING

Acme Refining Co., The, Cleveland, O.
American K. A. T. Corp., New York, N. Y.
American Teksag Products, Inc., Mount Vernon, N. Y.
Anderson-Stolz Corp., Kansas City, Mo.
Aquatic Chemical Laboratories, Inc., New York, N. Y
Blue Seal Chemical Co., Roselle Park, N. J.
Brown-Ford Corp., Newton, Mass.
•Cannon Chemical Co., Everett, Mass.
Chicago Specialty Mfg. Co., Chicago, Ill.
Continental Products Co., Euclid, O.
Dearborn Chemical Co., Chicago, Ill.
Diamond Chemical Products, New York, N. Y.
Ferro-Nil Corp., New York, N. Y.
Grief, Edward C., Bogota, N. J.
Hagan Corp., Pittsburgh, Pa.
Haering & Co., Inc., D. W., Chicago, Ill.
Hercules Chemical Co., Inc., New York, N. Y.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Krehbiel Co., J. H., Chicago, Ill.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
Munn and Steele, Inc., Newark, N. J.
National Aluminate Corp., Chicago, Ill.
North American Fibre Products Co., The, Cleveland, O.
Radiator Specialty Co., Charlotte, N. C.
Utility Laboratory, Inc., Brooklyn, N. Y.
Vinco Co., Inc., The, New York, N. Y.
Water Service Laboratories, Inc., New York, N. Y
Western Chemical Co., Kansas City, Mo.
X Laboratories, Inc., New York, N. Y.

COMPOUNDS, BOILER AND RADIATOR SEALING

Atlas Chemical Co., Marietta, O.
Blue Seal Chemical Co., Roselle Park, N. J.
•Cannon Chemical Co., Everett, Mass.
Chicago Specialty Mfg. Co., Chicago, Ill.
Cooper Sanitary Co., Philadelphia, Pa.
Dearborn Chemical Co., Chicago, Ill.
Desolvo Co., The, Pittsburgh, Pa.
Halowax Products Div., Union Carbide & Carbon Corp., New York, N. Y.
Hampton-Cross Co., The, Louisville, Ky.
Hercules Chemical Co., Inc., New York, N. Y.
Krehbiel Co., J. H., Chicago, Ill.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
National Engineering Products, Inc., Washington, D. C.
Permatex Co., Inc., Sheepshead Bay, N. Y.
Radiator Specialty Co., Charlotte, N. C.
Star Products Co., New York, N. Y.
Vinco Co., Inc., The, New York, N. Y.
X Laboratories, Inc., New York, N. Y.

COMPOUNDS, CAULKING

Accurate Metal Weather Strip Co., New York, N. Y.
Acme Refining Co., The, Cleveland, O.
All Metal Weatherstrip Co., Chicago, Ill.
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
American Metal Weather Strip Co., Grand Rapids, Mich.
Armstrong Co., The, Detroit, Mich.
Asphalt Products Co., Syracuse, N. Y.
Barber Asphalt Corp., Barber, N. J.
Barland Weatherstrip Material Co., Cleveland, O.
Calbar Paint & Varnish Co., Philadelphia, Pa.
•Carey Mfg. Co., Philip, Cincinnati, O.
Chamberlin Metal Weather Strip Co., Detroit, Mich.
Clinton Metallic Paint Co., Clinton, N. Y.
Continental Products Co., Euclid, O.
Flintkote Co., The, New York, N. Y.
Ford Roofing Products Co., Chicago, Ill.
Glidden Co., Cleveland, O.
Hetzel Roofing Products Co., Newark, N. J.
Horn Co., A. C., Long Island City, N. Y.
Iowa Paint Mfg. Co., Des Moines, Ia.
•Johns-Manville, New York, N. Y.
Klee Co., Geo. B., Cincinnati, O.
Krehbiel Co., J. H., Chicago, Ill.
Lastik Products Co., Inc., Pittsburgh, Pa.
Lehon Co., Chicago, Ill.
Maas & Waldstein Co., Newark, N. J.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
National Mfg. Corp., Tonawanda, N. Y.
Nebel Mfg. Co., Cleveland, O.
North American Fibre Products Co., The, Cleveland, O.
Ohmlac Paint & Refining Co., Chicago, Ill.
Pecora Paint Co., Philadelphia, Pa.
Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Plastic Products Co., Detroit, Mich.
Presstite Engineering Co., St. Louis, Mo.
Pyrolite Products Co., Cleveland, O.
Quigley Co., Inc., New York, N. Y.
Radiator Specialty Co., Charlotte, N. C.
Reilly Tar & Chemical Corp., Indianapolis, Ind.
Robertson Co., H. H., Pittsburgh Pa.

• Advertisement in this issue. See Index to Advertisers, page 306.

Sipe & Co., James B., Pittsburgh, Pa.
Smooth-On Mfg. Co., Jersey City, N. J.
Sonneborn Sons, Inc., L., New York, N. Y.
Thompson & Co., Pittsburgh, Pa.
Tropical Paint & Oil Co., Cleveland, O.
United States Stoneware Co., New York, N. Y.
Wilhelm Co., A., Reading, Pa.
●X-Pando Corp., Long Island City, N. Y.
Yardley Screen & Weather Strip Corp., Columbus, O.

COMPOUNDS, CLEANING, PIPE COIL AND CONDENSER

Anderson-Stolz Corp., Kansas City, Mo.
Aquatic Chemical Laboratories, Inc., New York, N. Y.
Blue Seal Chemical Co., Roselle Park, N. J.
●Cannon Chemical Co., Everett, Mass.
Dearborn Chemical Co., Chicago, Ill.
Forslund Pump & Machinery Co., Kansas City, Mo.
Haering Co., Inc., D. W., Chicago, Ill.
Hercules Chemical Co., Inc., New York, N. Y.
North American Fibre Products Co., The, Cleveland, O.
Oakite Products, Inc., New York, N. Y.
Radiator Specialty Co., Charlotte, N. C.
Utility Laboratory, Inc., Brooklyn, N. Y.
Western Chemical Co., Kansas City, Mo.

COMPRESSOR BASES

See Bases and Pads, Vibration Isolating

COMPRESSORS, AIR

Allen Billmyre Corp., Mamaroneck, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Beach-Russ Co., New York, N. Y.
Binks Mfg. Co., Chicago, Ill.
Brunner Mfg. Co., Utica, N. Y.
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Davey Compressor Co., Kent, O.
Dayton Air Compressor Co., Dayton, O.
DeVilbiss Co., The, Toledo, O.
Essick Mfg. Co., Los Angeles, Cal.
Fuller Co., Catasauqua, Pa.
Gardner-Denver Co., Quincy, Ill.
Gilbert & Barker Mfg. Co., West Springfield, Mass.
Hobart Bros. Co., Troy, O.
Ingersoll-Rand, New York, N. Y.
Lammert & Mann Co., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Nash Engineering Co., South Norwalk, Conn.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Plummer Spray Equipment Co., Napoleon, O.
Schramm, Inc., West Chester, Pa.
Spencer Turbine Co., Hartford, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Trimount Rotary Power Co., East Dedham, Mass.
Uniflow Mfg. Co., Erie, Pa.
Union Steam Pump Co., Battle Creek, Mich.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

COMPRESSORS, REFRIGERATING, CENTRIFUGAL

Carrier Corp., Syracuse, N. Y. (Carrene)
DeLaval Steam Turbine Co., Trenton, N. J. (Water vapor).
Ingersoll-Rand, New York, N. Y. (Water vapor).
●Trane Co., The, La Crosse, Wis.
●Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J.
York Ice Machinery Corp., York, Pa.

COMPRESSORS, REFRIGERATING, RECIPROCATING

Airtemp, Div. of Chrysler Corp., Dayton, O. (Radial).
●Baker Ice Machine Co., Inc., Omaha, Nebr. ("Freon," Methyl chloride, Ammonia).
Brunner Mfg. Co., Utica, N. Y. (Methyl chloride, "Freon," sulphur dioxide).
Carrier Corp., Syracuse, N. Y. ("Freon")
Copeland Refrigeration Corp., Sidney, O.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Diceler Corp., The, Greenville, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Frick Co., Waynesboro, Pa. (Ammonia, carbon dioxide, methyl chloride, "Freon").
Frigidaire Div., General Motors Corp., Dayton, O.
Gale Products, Galesburg, Ill.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Machinery Co., Spokane, Wash.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Howe Ice Machine Co., Chicago, Ill. ("Freon," ammonia, methyl chloride).
Ingersoll-Rand, New York, N. Y.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Lynch Mfg. Corp., Defiance, O.
Merchant & Evans Co., Philadelphia, Pa. ("Freon," methyl chloride, sulphur dioxide).
Mills Novelty Co., Chicago, Ill.
Phoenix Ice Machine Co., Cleveland, O.
Reliance Refrigerating Machine Co., Chicago, Ill. ("Freon," methyl chloride, ammonia).
Reynolds Mfg. Co., Inc., Springfield, Mo.
Servel, Inc., Electric Refrigeration & Air Conditioning Div., Evansville, Ind. ("Freon," methyl chloride).
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
Starr Piano Co., Richmond, Ind.
Stewart Ice Machine Co., Los Angeles, Cal.
Tecumseh Products Co., Tecumseh, Mich.
●Trane Co., The, La Crosse, Wis.
Uniflow Mfg. Co., Erie, Pa.
Universal Cooler Corp., Marion, O. (Methyl chloride, "Freon").
Vilter Mfg. Co., Milwaukee, Wis. ("Freon," ammonia)
Westinghouse Electric & Mfg. Co., Springfield, Mass.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill. ("Freon," methyl chloride).
Wittenmeier Machinery Co., Chicago, Ill. (Carbon dioxide).
●Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J.
XL Refrigerating Co., Chicago, Ill. (Ammonia, methyl chloride).
York Ice Machinery Corp., York, Pa. (Carbon dioxide, ammonia, "Freon").

COMPRESSORS, REFRIGERATING, STEAM JET

Croll-Reynolds Engrg. Co., Inc., New York, N. Y.
Elliott Co., Jeannette, Pa.
Ingersoll-Rand, New York, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J.

COMPRESSORS, STEAM BOOSTER

Ingersoll-Rand, New York, N. Y.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

CONDENSATION METERS

See Meters, Condensation

CONDENSATION PUMPS

See Pumps, Condensation

CONDENSERS, REFRIGERATING, EVAPORATIVE

●Acme Industries, Inc., Jackson, Mich.
American Cooling Tower Co., Kansas City, Mo.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Baltimore Air Coil Co., Baltimore, Md.
●Buffalo Forge Co., Buffalo, N. Y.
Carrier Corp., Syracuse, N. Y.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Faraday Engineering Co., Boston, Mass.
Frick Co., Waynesboro, Pa.
Frigidaire Div., General Motors Corp., Dayton, O.
●G & O Mfg. Co., New Haven, Conn.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Harry Cooling Towers, Inc., New York, N. Y.
Hess Warming & Ventilating Co., Chicago, Ill.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Larkin Coils, Inc., Atlanta, Ga.
Long Mfg., Div. Borg-Warner Corp., Detroit, Mich.
●Marlo Coil Co., St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
●Murray Mfg. Co., D. J., Wausau, Wis.
New England Cooling Tower Co., Boston, Mass.
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Richmond Engrg. Co., Inc., Richmond, Va.
●Trane Co., The, La Crosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J.
XL Refrigerating Co., Chicago, Ill.
Yates-American Machine Co., Beloit, Wis.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

● Advertisement in this issue. See Index to Advertisers, page 306.

CONDENSERS, REFRIGERATING, SHELL AND TUBE

●Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
●Bell & Gossett Co., Morton Grove, Ill.
Biggs Boiler Works Co., E. Akron, O.
●Bush Mfg. Co., Hartford, Conn.
Carrier Corp., Syracuse, N. Y. (Carrene).
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Downingtown Iron Works, Downingtown, Pa.
Drayer & Hanson, Inc., Los Angeles, Cal.
Frick Co., Waynesboro, Pa.
Frigidaire Div., General Motors Corp., Dayton, O.
●General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Heat Transfer Products, Inc., New York, N. Y.
Howard Iron Works & Alberger Heater Co., Buffalo, N. Y.
Howe Ice Machine Co., Chicago, Ill.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Kopperman & Sons, Joseph, Philadelphia, Pa.
●Kramer Trenton Co., Trenton, N. J.
Ohio Pipe Bending & Machine Co., Cleveland, O.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Refrigeration Economics Co., Inc., Canton, O.
Reliance Refrigerating Machine Co., Chicago, Ill.
Reynolds Mfg. Co., Inc., Springfield, Mo.
Richmond Engrg. Co., Inc., Richmond, Va.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Servel, Inc., Electric Refrigeration & Air Conditioning Div., Evansville, Ind.
Stewart Ice Machine Co., Los Angeles, Cal.
Struthers Wells Corp., Titusville, Pa.
Union Steam Pump Co., Battle Creek, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Whitlock Mfg. Co., Hartford, Conn.
Wittenmeier Machinery Co., Chicago, Ill.
●Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J.
XL Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.
Zallea Brothers & Johnson, Wilmington, Del.

CONDENSING UNITS

See Compressors

CONDUIT, UNDERGROUND PIPING

●American District Steam Co., North Tonawanda, N. Y.
Dockstader, S. E., Washington, D. C.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
●Johns-Manville, New York, N. Y.
Michigan Pipe Co., Bay City, Mich.
●Porter & Co., Inc., H. W., Newark, N. J.
●Ric-wiL Co., Cleveland, O.
●Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.
Underground Steam Construction Co., Boston, Mass.
Wyckoff & Son Co., A., Elmira, N. Y.

CONNECTIONS, DUCT, FLEXIBLE (ASBESTOS, CANVAS, ETC.)

Canvas Products Co., St. Louis, Mo.
Felters Co., Inc., Boston, Mass.
United States Rubber Co., New York, N. Y.
●Wilson, Inc., Grant, Chicago, Ill. (Asbestos).

CONTROL, FOR INDIRECT WATER HEATERS

●Bell & Gossett Co., Morton Grove, Ill.
●Mercoid Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
●Trane Co., The, La Crosse, Wis.

CONTROLLERS AND STARTERS, MOTOR

Allen-Bradley Co., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Bender Warrick Corp., Birmingham, Mich.
Clark Controller Co., Cleveland, O.
Cutler-Hammer, Inc., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
Electric Machinery Co., Minneapolis, Minn. (Synchronous motor).
●General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn.
Monitor Controller Co., The, Baltimore, Md.
Ohio Brass Co., Mansfield, O.
●Penn Electric Switch Co., Goshen, Ind.
Reynolds Electric Co., Chicago, Ill.
Square D Co., Industrial Controller Div., Milwaukee, Wis.
Trumbull Electric Mfg. Co., Plainville, Conn.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Zenith Electric Co., Chicago, Ill.

CONTROLS, DOOR, ELECTRIC EYE (FOR AIR CONDITIONED ROOMS)

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Yale & Towne Mfg. Co., Stamford, Conn.

CONTROLS, DRAFT, BAROMETRIC

Field Control Div., H. D. Conkey & Co., Mendota, Ill.
Preferred Utilities Mfg. Corp., New York, N. Y.
Simplex Mfg. Co., Fond du Lac, Wis.

CONTROLS, FIRE PROTECTION SPRINKLER SYSTEMS

●Barber-Colman Co., Rockford, Ill.
●Grinnell Co., Inc., Providence, R. I.
Rockwood Sprinkler Co., Worcester, Mass.
Square D Co., Detroit, Mich.

CONVECTORS

See Radiation, Convection Type

COOLERS, OIL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Andale Co., Philadelphia, Pa.
American Locomotive Co., Alco Products Div., New York, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Davis Engineering Corp., Elizabeth, N. J.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Downingtown Iron Works, Downingtown, Pa.
Elliott Co., Jeannette, Pa.
Frank Heaters, Inc., Paterson, N. J.
●G & O Mfg. Co., New Haven, Conn.
Griscom-Russell Co., The, New York, N. Y.
●Kramer Trenton Co., Trenton, N. J.
●Modine Mfg. Co., Racine, Wis.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
●Shaw-Perkins Mfg. Co., Pittsburgh, Pa.
Sims Co., Erie, Pa.
Standard Heater & Oil Equipment Co., Jersey City N. J.
Struthers Wells Corp., Titusville, Pa.
●Trane Co., The, La Crosse, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Whitlock Mfg. Co., Hartford, Conn.
●Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.
Zallea Brothers & Johnson, Wilmington, Del.

COOLERS, UNIT (FLOOR TYPE)

Not air conditioning units, but floor mounted unit with coil and centrifugal fans without filters, for connection to remote compressor or cold water supply. For air conditioning units see Units, Air Conditioning

●Acme Industries, Inc., Jackson, Mich.
American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Beacon-Morris Corp., Boston, Mass. (Custom built)
●Buffalo Forge Co., Buffalo, N. Y.
●Bush Mfg. Co., Hartford, Conn.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Economy Equipment Co., Chicago, Ill.
Frick Co., Waynesboro, Pa.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Howe Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
●Kramer Trenton Co., Trenton, N. J.
Larkin Coils, Inc., Atlanta, Ga.
●Marlo Coil Co., St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.

● Advertisement in this issue. See Index to Advertisers, page 306.

●**Murray Mfg. Co., D. J., Wausau, Wis.**
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Richmond Engineering Co., Inc., Richmond, Va.
●Skinner Heating & Ventilating Co., Inc., Div. of St. Louis **Blow Pipe & Heater Co., St. Louis, Mo.**
●Trane Co., The, La Crosse, Wis.
●**U. S. Air Conditioning Corp., Minneapolis, Minn.**
Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●**Young Radiator Co., Racine, Wis.**

COOLERS, UNIT (SUSPENDED TYPE)

Not air conditioning units, but suspended unit with coil and propellor fan, ***without filters, for connection to remote compressor or cold water*** *supply. For air conditioning units, see Units, Air Conditioning*

●Acme Industries, Inc., Jackson, Mich.
American Blower Corp., Detroit, Mich.
American Coils, Inc., Newark, N. J.
●**Baker Ice Machine Co., Inc., Omaha, Nebr.**
Beacon-Morris Corp., Boston, Mass. (Custom built)
Berns Specialty Mfg. Co., Chicago, Ill.
Betz Corp., Hammond, Ind.
●**Buffalo Forge Co., Buffalo, N. Y.**
●**Bush Mfg. Co., Hartford, Conn.**
Carrier Corp., Syracuse, N. Y.
●**Clarage Fan Co., Kalamazoo, Mich.**
Conditionaire Unit Co., Chicago, Ill.
●**Curtis Refrigerating Machine Co., St. Louis, Mo.**
Drayer & Hanson, Inc., Los Angeles, Cal.
●**Fedders Mfg. Co., Inc., Buffalo, N. Y.**
●**General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.**
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Howe Ice Machine Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
●Kramer Trenton Co., Trenton, N. J.
Larkin Coils, Inc., Atlanta, Ga.
●**Marlo Coil Co., St. Louis, Mo.**
●McCord Radiator & Mfg. Co., Detroit, Mich.
●**McQuay, Inc., Minneapolis, Minn.**
Merchant & Evans Co., Philadelphia, Pa.
●**Murray Mfg. Co., D. J., Wausau, Wis.**
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Richmond Engrg. Co., Inc., Richmond, Va.
●Skinner Heating & Ventilating Co., Inc., Div. of St. Louis **Blow Pipe & Heater Co., St. Louis, Mo.**
Super Radiator Corp., Minneapolis, Minn.
Thermal Co., Inc., Milwaukee, Wis.
●Trane Co., The, La Crosse, Wis.
●**U. S. Air Conditioning Corp., Minneapolis, Minn.**
Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●**Wing Mfg. Co., L. J., New York, N. Y.**
●Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●**Young Radiator Co., Racine, Wis.**

COOLING COILS

See Surface, Cooling

COOLING SURFACE

See Surface, Cooling

COOLING TOWERS

See Towers, Cooling

COOLING UNITS

See Units, Air Conditioning; Coolers, Unit

COPPER PIPE

See Pipe, Brass and Copper

COPPER SHEETS

See Sheets, Copper

COPPER TUBE FITTINGS

See Fittings, Copper Tube

COPPER TUBING

See Tubing, Brass and Copper

CORROSION PREVENTIVE

See Treatment, Steam System, to Inhibit Corrosion; and *Treatment, Water, to Inhibit Corrosion*

COUNTERS, DUST

Bausch & Lomb Optical Co., Rochester, N. Y.
Service to Industry, West Hartford, Conn.
Willson Products, Inc., Reading, Pa.

COUPLINGS, FLEXIBLE, POWER TRANSMISSION

Ajax Flexible Coupling Co., Westfield, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Flexible Coupling Co., Erie, Pa.
Blood Brothers Machine Co., Allegan, Mich. (Universal joints)
Boston Gear Wks., Inc., North Quincy, Mass.
Caldwell Co., W. E., Louisville, Ky.
Certified Flexible Couplings, New York, N. Y.
Chain Belt Co., Milwaukee, Wis.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Congress Die Casting Div., Congress Tool & Die Co., De**troit, Mich.**
Continental Diamond Fibre Co., Newark, Del.
Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.
De Laval Steam Turbine Co., Trenton, N. J.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Dodge Mfg. Corp., Mishawaka, Ind.
Flexo Supply Co., Inc., St. Louis, Mo.
Guardian Utilities Co., Michigan City, Ind.
Jeffrey Mfg. Co., Columbus, O.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Koppers Co., Bartlett Hayward Div., Baltimore, Md.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Link-Belt Co., Indianapolis, Ind.
Lord Mfg. Co., Erie, Pa.
Lovejoy Flexible Coupling Co., Chicago, Ill.
Medart Co., St. Louis, Mo.
Mercury Clutch Corp., Massillon, O.
Moran Flexible Steam Joint Co., Louisville, Ky.
Morse Chain Co., Ithaca, N. Y.
Poole Foundry & Machine Co., Baltimore, Md.
Ramsey Chain Co., Inc., Albany, N. Y.
Shallcross Co., Philadelphia, Pa.
Smith, Inc., Winfield H., Springville, N. Y.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
United States Rubber Co., New York, N. Y.
Waldron Corp., John, New Brunswick, N. J.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Whitney Chain & Mfg. Co., The, Hartford, Conn.
Wood's Sons Co., T. B., Chambersburg, Pa.

COUPLINGS, PIPE

Alabama Pipe Co., Anniston, Ala. (Cast iron).
●**Byers Co., A. M., Pittsburgh, Pa.**
Champion Machine & Forging Co., Cleveland, O.
Clow & Sons, James B., Chicago, Ill.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
●**Crane Co., Chicago, Ill.**
Detroit Brass & Malleable Works, Detroit, Mich.
Dillon Co., Tulsa, Okla.
Dresser Mfg. Co., Bradford, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
●Flori Pipe Co., The, St. Louis, Mo.
Grabler Mfg. Co., Cleveland, O.
●**Grinnell Co., Inc., Providence, R. I.**
H. & B. Sales Co., Ltd., Long Beach, Cal. (Swing joint)
Hanlon-Waters, Inc., Tulsa, Okla.
Harrisburg Steel Corp., Harrisburg, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jefferson Union Co., Lexington, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
Malleable Iron Fittings Co., Branford, Conn.
●**Mueller Brass Co., Port Huron, Mich.**
National Tube Co., United States Steel Corp. Sub., Pitts**burgh, Pa.**
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ravena Iron Co., Ravena, N. Y. (Cast iron).
Republic Steel Corp., Cleveland, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Semler Co., Jeannette, Pa.
Stockham Pipe Fittings Co., Birmingham, Ala.
Stokes Rubber Co., Jos., Trenton, N. J. (Hard rubber)

● Advertisement in this issue. See Index to Advertisers, page 306.

Superior Railway Products Corp., Pittsburgh, Pa.
Victaulic Co. of America, New York, N. Y.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
●Watson-Stillman Co., Roselle, N. J.
Weatherhead Co., Cleveland, O.
Wheeling Machine Products Co., Wheeling, W. Va.
●Youngstown Sheet & Tube Co., Youngstown, O.

COUPLINGS, PIPE, DETACHABLE

Packless Metal Products Corp., New Rochelle, N. Y.
Victaulic Co. of America, New York, N. Y.

CUT-OFFS, LOW WATER, HEATING BOILER

Bender Warrick Corp., Birmingham, Mich.
●General Controls Co., Glendale, Calif.
Johnson Corp., Three Rivers, Mich.
●Kieley & Mueller, Inc., North Bergen, N. J.
Maid-O'-Mist, Inc., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
●Mercoid Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Penn Electric Switch Co., Goshen, Ind.
Schaub Engineering Co., Fred H., Chicago, Ill.
Strong, Carlisle & Hammond Co., Cleveland, O.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

CUTTERS, PIPE

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Barnes Tool Co., The, New Haven, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Bernz Co., Inc., Otto, Rochester, N. Y.
Crown Die & Tool Co., Chicago, Ill.
Erie Tool Works, Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
International Nutyp Tool Co., Oswego, N. Y.
Jarecki Mfg. Co., Erie, Pa.
National Machine Wks., Chicago, Ill.
Nye Tool & Machine Works, The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Ridge Tool Co., Elyria, O.
Sac Tool Mfg. Co., St. Louis, Mo.
Toledo Pipe Threading Machine Co., Toledo, O.
Trimont Mfg. Co., Boston, Mass.
Wallace Supplies Mfg. Co., Chicago, Ill.

CUTTERS, TUBING

Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Bernz Co., Inc., Otto, Rochester, N. Y.
●Bonney Forge & Tool Works, Allentown, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Mueller Brass Co., Port Huron, Mich.
Nye Tool & Machine Works, The, Chicago, Ill.
Parker Appliance Co., Cleveland, O.
Perfection Refrigeration Parts Co., Harvey, Ill.
Ridge Tool Co., Elyria, O.
Sac Tool Mfg. Co., St. Louis, Mo.
Snap-On Tools Corp., Kenosha, Wis.
Trimont Mfg. Co., Boston, Mass.
Wallace Supplies Mfg. Co., Chicago, Ill.
Weatherhead Co., Cleveland, O.

DAMPER OPERATORS

See Operators, Damper

DAMPER REGULATORS

See Regulators, Damper Sets

DAMPERS, DUCT, MANUALLY OPERATED

Acme Tin Plate & Roofing Supply Co., Philadelphia, Pa.
Air Conditioning Products Co., Detroit, Mich.
Corbman Bros., Inc., Philadelphia, Pa.
Elgo Shutter & Mfg. Co., Detroit, Mich.
Excelsior Steel Furnace Co., Chicago, Ill.
Jacobs Co., B. & J., Cincinnati, O.
Kerentoff, G. L., Cincinnati, O.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Salina Metal Products Co., Salina, Kans.
United States Register Co., Battle Creek, Mich.
Waterloo Register Co., Waterloo, Ia.

DAMPERS, DUCT, REMOTE CONTROLLED

Air Conditioning Products Co., Detroit, Mich.
American Warming & Ventilating Co., Toledo, O.
Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Brooke Engineering Co., Inc., Philadelphia, Pa.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Penn Electric Switch Co., Goshen, Ind.
●Powers Regulator Co., Chicago, Ill.
Shallcross Controls, Inc., Milwaukee, Wis.
Stuart Co., W. W., Des Moines, Ia.
●Tuttle & Bailey, Inc., New Britain, Conn.
Vapor Car Heating Co., Inc., Chicago, Ill.
Waterloo Register Co., Waterloo, Ia.
Young Regulator Co., Cleveland, O.

DEAERATORS

Cochrane Corp., Philadelphia, Pa.
Croll-Reynolds Engrg. Co., Inc., New York, N. Y.
Elliott Co., Jeannette, Pa.
Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
Heat Transfer Products, Inc., New York, N. Y.
Hoppes Mfg. Co., Springfield, O.
Permutit Co., New York, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Swartwout Co., Cleveland, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.

DEEP WELL PUMPS

See Pumps, Deep Well

DEHUMIDIFIERS, ABSORPTION AND ADSORPTION

●Air & Refrigeration Corp., New York, N. Y.
American Injector Co., Detroit, Mich.
Aqua-Sorb Co., East Orange, N. J.
Bryant Heater Co., The, Cleveland, O. (Silica gel)
Carbide and Carbon Chemicals Corp., New York, N. Y. (Triethylene Glycol)
Carrier Corp., Syracuse, N. Y.
Davison Chemical Corp., The, Baltimore, Md.
Floridin Co., Warren, Pa.
General Air Conditioning Corp., Cincinnati, O.
Kaufman, H. J., Detroit, Mich.
Pittsburgh Lectrodryer Corp., Pittsburgh, Pa.
Research Corp., New York, N. Y.
Solvay Sales Corp., New York, N. Y.
Surface Combustion, Toledo, O.

DEHUMIDIFYING UNITS

See Units, Air Conditioning; Dehumidifiers, Absorption and Adsorption

DEHYDRANT AND ACID NEUTRALIZER, FOR REFRIGERATING SYSTEMS

American Injector Co., Detroit, Mich.
Davison Chemical Corp., The, Baltimore, Md.
Highside Chemicals Co., Newark, N. J.
Weatherhead Co., Cleveland, O.

DEHYDRATORS, REFRIGERANT

Aluminum Co. of America, Pittsburgh, Pa.
American Injector Co., Detroit, Mich.
Davison Chemical Corp., The, Baltimore, Md.
Floridin Co., Warren, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
●Research Products Corp., Madison, Wis.
Weatherhead Co., Cleveland, O.

DESTROYERS, SOOT, CHEMICAL

Desolvo Co., The, Pittsburgh, Pa.
Hercules Chemical Co., Inc., New York, N. Y.

DESUPERHEATERS, STEAM

Edge Moor Iron Works, Inc., New York, N. Y.
Foster Wheeler Corp., New York, N. Y.
Hagan Corp., Pittsburgh, Pa.
Northern Equipment Co., Erie, Pa.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.

DETECTORS, LEAK, REFRIGERANT

Bernz Co., Inc., Otto, Rochester, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill. (Leak alarm)
Turner Brass Wks., Sycamore, Ill.

● Advertisement in this issue. See Index to Advertisers, page 306.

DIAPHRAGM VALVES
See Valves, Diaphragm

DIESEL ENGINES
See Engines, Diesel, for Fan, Pump and Compressor Drives

DIFFUSERS, AIR, HIGH VELOCITY
See also Grilles and Registers

Air Devices, Inc., New York, N. Y.
●Air & Refrigeration Corp., New York, N. Y.
●Anemostat Corp. of America, New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
●Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.
Demuth & Sons, Charles, Garden City Park, L. I.
Guth Co., Edwin F., St. Louis, Mo.
●Tuttle & Bailey, Inc., New Britain, Conn.
Waterloo Register Co., Waterloo, Ia.

DOOR CONTROLS
See Controls, Door, Electric Eye

DOORS AND PANELS, ACCESS

American Foundry & Furnace Co., Bloomington, Ill.
American Sheet Metal Works, New Orleans, La.
●Auer Register Co., Cleveland, O.
●Clarage Fan Co., Kalamazoo, Mich.
Falstrom Co., Passaic, N. J.
Higgin Products, Inc., Newport, Ky.
Kirk & Blum Mfg. Co., Cincinnati, O.
Milcor Steel Co., Milwaukee, Wis.
Rock Island Register Co., Rock Island, Ill.
Truscon Steel Co., Youngstown, O.
●Tuttle & Bailey, Inc., New Britain, Conn.
Way Loctor Access Panel Co., Boston, Mass.

DRAFT CONTROL
See Controls, Draft, Barometric; Regulators, Draft, Combustion

DRAFT GAGES
See Gages, Indicating, Draft

DRAFT RECORDERS
See Recorders, Draft

DRAFT REGULATORS
See Controls, Draft, Barometric; Regulators, Draft, Combustion

DRILLS, ELECTRIC, PORTABLE

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., New York, N. Y.
Cincinnati Electrical Tool Co., The, Cincinnati, O.
Clark, Jr., Electric Co., Jas., Louisville, Ky.
Independent Pneumatic Tool Co., Chicago, Ill.
Mall Tool Co., Chicago, Ill.
Millers Falls Co., Greenfield, Mass.
Misener Mfg. Co., Inc., Syracuse, N. Y.
Paramount Products Co., New York, N. Y.
Power King Tool Corp., Warsaw, Ind.
Signal Electric Mfg. Co., Menominee, Mich.
Skilsaw, Inc., Chicago, Ill.
Snap-On Tools Corp., Kenosha, Wis.
Speedway Mfg. Co. (Cicero), Ill.
Stanley Electric Tool Div., The Stanley Works, New Britain, Conn.
Syntron Co., Homer City, Pa.
U. S. Electrical Tool Co., Cincinnati, O.
Van Dorn Electric Tool Co., Towson, Md.
Willy's Carbide Tool Co., Detroit, Mich.
Wodack Electric Tool Corp., Chicago, Ill.

DRIVES, CHAIN

Caldwell Co., W. E., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Indianapolis, Ind.
Medart Co., St. Louis, Mo.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Whitney Chain & Mfg. Co., The, Hartford, Conn.

DRIVES, FLAT BELT
See also Belting, Leather and Belting, Rubber

American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Caldwell Co., W. E., Louisville, Ky.
Chicago Belting Co., Chicago, Ill.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
Gates Rubber Co., The, Denver, Colo.
Medart Co., St. Louis, Mo.
●Rhoads & Sons, J. E., Philadelphia, Pa.
Rockwood Mfg. Co., Indianapolis, Ind.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
Williams & Son, I. B., Dover, N. H.
Wood's Sons Co., T. B., Chambersburg, Pa.

DRIVES, V BELT

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Chicago Belting Co., Chicago, Ill.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Congress Die Casting Div., Congress Tool & Die Co., Detroit, Mich.
Continental Rubber Wks., Erie, Pa.
Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
Gates Rubber Co., Denver, Colo.
Goodrich Co., B. F., Akron, O.
Horton Mfg. Co., Minneapolis, Minn.
Ideal Commutator Dresser Co., Sycamore, Ill.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Medart Co., St. Louis, Mo.
Pyott Foundry & Machine Co., Chicago, Ill.
Rockwood Mfg. Co., Indianapolis, Ind.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
Wood's Sons Co., T. B., Chambersburg, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

DUAL THERMOSTATS
See Thermostats, Two Temperature or Dual

DUCT CONNECTIONS
See Connections, Duct, Flexible

DUCT HEATERS
See Heaters, Duct

DUCT INSULATION
See Insulation, Duct

DUCT THERMOSTATS
See Thermostats, Duct Type

DUCT TURNING VANES
See Vanes, Duct Turning, Prefabricated

DUCTS AND DUCT FITTINGS, PREFABRICATED, METALLIC

Acer & Whedon, Inc., Medina, N. Y.
Acme Tin Plate & Roofing Supply Co., Philadelphia, Pa.
Champion Furnace Pipe Co, Peoria, Ill.
Chandler Co., Cedar Rapids, Ia.
Char-Gale Mfg. Co., Minneapolis, Minn.
Chicago Furnace Supply Co., Chicago, Ill.
Chicago Metal Hose Corp., Maywood, Ill. (For aircraft)
Cincinnati Sheet Metal & Roofing Co., Cincinnati, O.
Corbman Bros., Inc., Philadelphia, Pa.
Excelsior Steel Furnace Co., Chicago, Ill.
Gray Metal Products, Inc., Rochester, N. Y.
Henry Furnace & Foundry Co., Cleveland, O.
Howes-Woods Co., Cambridge, Mass.
International Heater Co., Utica, N. Y.
Jacobs Co., B. & J., Cincinnati, O.
Lamneck Products, Inc., Middletown, O.
Meyer & Bro. Co., F., Peoria, Ill.
Milcor Steel Co., Milwaukee, Wis.
Moncrief Furnace Co., Atlanta, Ga.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa
Season-Aire Corp. of America, Detroit, Mich.
Smith-Raymond Co., Columbus, Ga.
United States Register Co., Battle Creek, Mich.
Williamson Heater Co., Cincinnati. O.

DUCTS AND DUCT FITTINGS, PREFABRICATED, NON-METALLIC

Airtemp, Div. of Chrysler Corp., Dayton, O.
●Carey Mfg. Co., Philip, Cincinnati, O.
Smith-Raymond Co., Columbus, Ga.

DUST COLLECTORS
See Collectors, Dust

DUST COUNTERS
See Counters, Dust

● Advertisement in this issue. See Index to Advertisers, page 306.

EJECTORS, SEWAGE

American-Marsh Pumps, Inc., Battle Creek, Mich.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Works Co., Columbus, O.
●Economy Pumps, Inc., Hamilton, O.
●Nash Engineering Co., South Norwalk, Conn.
Penberthy Injector Co., Detroit, Mich.
Quimby Pump Co., Inc., Newark, N. J.
Schutte & Koerting Co., Philadelphia, Pa.
Swaby Mfg. Co., Chicago, Ill.
Taber Pump Co., Inc., Buffalo, N. Y.
Weil Pump Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

ELECTRIC AIR CLEANERS

See Cleaners, Air, Electrical

ELECTRIC DRILLS

See Drills, Electric, Portable

ELECTRIC MOTORS

See Motors, Electric

ELECTRIC SHEARS

See Shears, Electric, Portable

ELECTRIC UNIT HEATERS

See Heaters, Unit, Electric Heating Element

ELECTRIC WATER HEATERS

See Heaters, Water, Electric

ELECTRODES, ARC WELDING

●Air Reduction Sales Co., New York, N. Y.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Allied Weld-Craft, Inc., Indianapolis, Ind.
Aluminum Co. of America, Pittsburgh, Pa.
American Agile Corp., Cleveland, O.
●American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Cleveland, O.
Arcos Corp., Philadelphia, Pa.
Chicago Steel & Wire Co., Chicago, Ill.
Electric Arc, Inc., Newark, N. J.
Ergolyte Mfg. Co. Philadelphia, Pa.
Eutectic Welding Alloys Co., New York, N. Y.
●General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee, Wis.
Hobart Bros. Co., Troy, O.
Laclede Steel Co., St. Louis, Mo.
Lincoln Electric Co., Cleveland, O.
Marquette Mfg. Co., Minneapolis, Minn.
Maurath, Inc., Cleveland, O.
McKay Co., York, Pa.
Metal & Thermit Corp., New York, N. Y.
National Cylinder Gas Co., Chicago, Ill.
Page Steel & Wire Division of American Chain & Cable Co., Inc., Monessen, Pa.
Revere Copper and Brass, Incorporated, New York, N. Y.
Seneca Wire & Mfg. Co., Fostoria, O.
Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.
Una Welding, Inc., E. Cleveland, O.
Universal Power Corp., Cleveland, O.
Welding Apparatus Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metals Co., Inc., New York, N. Y.

ELIMINATORS, AIR, FOR HEATING AND PIPING SYSTEMS

●Anderson Co., V. D., The, Cleveland, O.
Anderson Products, Inc., Cambridge, Mass.
●Armstrong Machine Works, Three Rivers, Mich.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
●Burnham Boiler Corp., Irvington, N. Y.
Dole Valve Co., The, Chicago, Ill.
●Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Maid-O'-Mist, Inc., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
●Sarco Co., Inc., New York, N. Y.
Sterling, Inc., Milwaukee, Wis.
Triplex Heating Specialty Co., Peru, Ind.
Vapor Specialty Co., New York, N. Y.
Wright-Austin Co., Detroit, Mich.

ENAMELS AND LACQUERS

Acme White Lead & Color Works, Detroit, Mich.
Acorn Refining Co., Cleveland, O.
Baer Bros., New York, N. Y.
Debevoise Co., The, Brooklyn, N. Y.
Detroit Graphite Co., Detroit, Mich.
Dragert Co., Inc., C. H., Brooklyn, N. Y.
du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.
Fales Chemical Co., Inc., The, New York, N. Y.
Ferro-Enamel Corp., Cleveland, O.
Glidden Co., Cleveland, O.
Hague & Co., Inc., Alfred, Brooklyn, N. Y.
Hilo Varnish Corp., Brooklyn, N. Y.
Horn Co., A. C., Long Island City, N. Y.
Inter-Coastal Paint Corp., East St. Louis, Ill.
Krehbiel Co., J. H., Chicago, Ill.
Maas & Waldstein Co., Newark, N. J.
O'Brien Varnish Co., South Bend, Ind.
Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Quigley Co., Inc., New York, N. Y.
Roxalin Flexible Finishes, Inc., Elizabeth, N. J.
Sonneborn Sons, Inc., L., New York, N. Y.
Thompson & Co., Pittsburgh, Pa.
Tropical Paint & Oil Co., Cleveland, O.
Wailes Dove-Hermiston Corp., Westfield, N. J.
Wilhelm Co., A., Reading, Pa.
Zapon Div., Atlas Powder Co., North Chicago, Ill.

ENGINES, DIESEL, FOR FAN, PUMP AND COMPRESSOR DRIVES

American Locomotive Co., Auburn, N. Y.
Anderson Engine & Foundry Co., Anderson, Ind.
Baldwin De La Vergne Sales Corp., Philadelphia, Pa.
Bardco Mfg. & Sales Co., Los Angeles, Cal.
Buda Co., Harvey, Ill.
Caterpillar Tractor Co., Peoria, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Fairbanks, Morse & Co., Chicago, Ill.
General Motors Corp., Detroit, Mich.
Hill Diesel Engine Co., Lansing, Mich.
Ingersoll-Rand, New York, N. Y.
Waukesha Motor Co., Waukesha, Wis.
Witte Engine Works, Kansas City, Mo.
●Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES, GAS, FOR FAN, PUMP AND COMPRESSOR DRIVES

Bardco Mfg. & Sales Co., Los Angeles, Cal.
Caterpillar Tractor Co., Peoria, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
Continental Motors Corp., Detroit, Mich.
Cooper-Bessemer Corp., The, Mt. Vernon, O.
Fairbanks, Morse & Co., Chicago, Ill.
Ingersoll-Rand, New York, N. Y.
U. S. Motors Corp., Oshkosh, Wis.
Universal Motor Co., Oshkosh, Wis.
Waukesha Motor Co., Waukesha, Wis.
Williamsport Engine & Machine Co., Williamsport, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES, STEAM, FOR FAN, PUMP AND COMPRESSOR DRIVES

Ames Iron Wks., Div. of Pierce, Butler Radiator Corp., Oswego, N. Y.
Elliott Co., Jeannette, Pa.
Frick Co., Waynesboro, Pa.
Harrisburg Machinery Corp., Harrisburg, Pa.
Morris Machine Wks., Baldwinsville, N. Y.
Murray Iron Wks Co., Burlington, Ia.
Skinner Engine Co., Erie, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Troy Engine & Machine Co., Troy, Pa.
Vilter Mfg. Co., Milwaukee, Wis.

EQUIPMENT, BALANCING

Bear Mfg. Co., Rock Island, Ill.
Gisholt Machine Co., Madison, Wis.

EVAPORATIVE CONDENSERS

See Condensers, Refrigerating, Evaporative

EXHAUST HEADS

See Heads, Exhaust, for Pipe Lines

EXHAUSTERS, WELDING FUME

Belanger Fan & Blower Co., Detroit, Mich.
Chelsea Fan & Blower Co., Irvington, N. J.
Chicago Pneumatic Tool Co., New York, N. Y.
Coppus Engineering Corp., Worcester, Mass.
Faraday Engineering Co., Boston, Mass.

● Advertisement in this issue. See Index to Advertisers, page 306.

Ruemelin Mfg. Co., Milwaukee, Wis.
Sawyer Electrical Mfg. Co., Los Angeles, Cal.
Torit Mfg. Co., St. Paul, Minn.
Utility Fan Corp., Los Angeles, Cal.

EXPANSION BENDS
See Bends, Expansion

EXPANSION BOLTS
See Bolts, Expansion

EXPANSION JOINTS
See Joints, Pipe, Expansion

EXPANSION TANKS
See Tanks, Expansion, for Hot Water Heating Systems

EXPANSION VALVES
See Valves, Refrigeration

EXTRACTORS, PIPE
Greenfield Tap & Die Corp., Greenfield, Mass.
Reps Tool Co., Inc., New York, N. Y.
Ridge Tool Co., Elyria, O.

FABRICATED PIPING
See Bends; Headers; Joints; etc.

FABRICATORS, PIPE
See Headers, Welded; and Coils, Pipe

FAN BALANCING EQUIPMENT
See Equipment, Balancing

FAN BASES
See Bases and Pads, Vibration Isolating

FAN BLADES
See Blades, Propeller Fan

FAN HOUSINGS
See Housings, Fan, Centrifugal

FANS, CENTRIFUGAL
Advance Aluminum Castings Corp., Chicago, Ill.
Advance Fan & Blower Co., Detroit, Mich.
Air Controls, Inc., Cleveland, O.
●Airtherm Mfg. Co., St. Louis, Mo.
Allen Billmyre Corp., Mamaroneck, N. Y.
American Blower Corp., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Furnace Co., St. Louis, Mo.
Ames Co., W. R., San Francisco, Cal.
Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.
Ballantyne Co., Omaha, Nebr.
Bayley Blower Co., Milwaukee, Wis.
Berns Specialty Mfg. Co., Chicago, Ill.
Bishop & Babcock Mfg. Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
Brundage Co., The, Kalamazoo, Mich.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., Des Moines, Ia.
Campbell Heating Co., E. K., Kansas City, Mo.
Carrier Corp., Syracuse, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., Irvington, N. J.
●Clarage Fan Co., Kalamazoo, Mich.
Coppus Engineering Corp., Worcester, Mass.
Duriron Co., Inc., Dayton, O. (Acid resisting).
Eclipse Fuel Engineering Co., Rockford, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Essick Mfg. Co., Los Angeles, Cal.
Furblo Co., Hermansville, Mich.
Garden City Fan Co., Chicago, Ill.
General Blower Co., Inc., Philadelphia, Pa.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Grand Rapids Die & Tool Co., Grand Rapids, Mich.
Hall Mfg. Co., Cedar Rapids, Ia.
Hastings Air Conditioning Co., Hastings, Neb.
Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Nebr.
Jeffrey Mfg. Co., Columbus, O.
Johnson Fan & Blower Corp., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Lau Blower Co., Dayton, O.
Lehigh Fan & Blower Co., Allentown, Pa.
Leinweber Fan & Blower Co., Chicago, Ill.
Magirl Foundry & Furnace Works, P. H., Bloomington, Ill.
Montag Stove & Furnace Wks., Portland, Ore.
Morrison Products, Inc., Cleveland, O.
Mountain States Equipment Co., Denver, Colo.
National Engineering & Mfg. Co., Kansas City, Mo.
National Mfg. & Engineering Co., Detroit, Mich.
●New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Northern Blower Co., Cleveland, O.
Northwest Stove & Furnace Wks., Inc., Portland, Ore.
Palmer Mfg. Corp., Phoenix, Ariz.
Peerless Electric Co., Warren, O.
Phelps Mfg. Co., Little Rock, Ark.
Prat-Daniel Corp., Port Chester, N. Y.
Reynolds Mfg. Co., The, Grand Rapids, Mich.
Royal Air Conditioning Equipment Co., Alhambra, Cal.
Schwitzer-Cummins Co., Indianapolis, Ind.
Semco Mfg. Co., Nashville, Tenn.
●Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
Stainless & Steel Products Co., St. Paul, Minn.
Sturtevant Co., B. F., Boston, Mass.
Supreme Heater & Ventilating Corp., Bonner Springs, Kans.
Torit Mfg. Co., St. Paul, Minn.
Trade-Wind Motorfans, Inc., Los Angeles, Cal.
●Trane Co., The, La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.

FANS, PROPELLER
Aerovent Fan Co., Piqua, O.
Air Controls, Inc., Cleveland, O.
Aire-Foile Fan & Blower Co., Detroit, Mich.
Airmaster Corp., Chicago, Ill.
●Airtherm Mfg. Co., St. Louis, Mo.
Allen Corp., Detroit, Mich.
American Blower Corp., Detroit, Mich.
American Coolair Corp., Jacksonville, Fla.
Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Belanger Fan & Blower Co., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., St. Louis, Mo.
Berns Specialty Mfg. Co., Chicago, Ill.
Bishop & Babcock Mfg. Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., Irvington, N. J.
Circulators & Devices Mfg. Corp., New York, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Coppus Engineering Corp., Worcester, Mass.
Dallas Engineering Co., Inc., Dallas, Tex.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Diehl Mfg. Co., Elizabethport, N. J.
Dual Air Fan Co., Chicago, Ill.
Earl Co., Warren, Houston, Tex.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Emerson Electric Mfg. Co., The, St. Louis, Mo.
Fresh'nd-Aire Co., Chicago, Ill.
Garden City Fan Co., Chicago, Ill.
General Blower Co., Inc., Philadelphia, Pa.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Guth Co., Edwin F., St. Louis, Mo.
Hall Mfg. Co., Cedar Rapids, Ia.
Hartzell Propeller Fan Co., Piqua, O.
Hirschman Co., W. F., Buffalo, N. Y.
Holtum Mfg. Co., Freeport, Ill.
Hunter Fan & Ventilating Co., Inc., Memphis, Tenn.
Ilg Electric Ventilating Co., Chicago, Ill.
International Engineering, Inc., Dayton, O.
Jamieson Mfg. Co., Dallas, Tex.
Jeffrey Mfg. Co., Columbus, O.
Johnson Fan & Blower Corp., Chicago, Ill.
Johnston Co., William W., Dayton, O.
Jordan & Co., Paul R., Indianapolis, Ind.
King Ventilating Co., Owatonna, Minn.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Lau Blower Co., Dayton, O.
Lohman Co., Wm. J., Irvington, N. J.
Marathon Electric Mfg. Corp., Wausau, Wis.
●McCord Radiator & Mfg. Co., Detroit, Mich.
Meier Electric & Machine Co., Indianapolis, Ind.
Mountain States Equipment Co., Denver, Colo.
Myers Electric Co., Inc., Pittsburgh, Pa.
National Engineering & Mfg. Co., Kansas City, Mo.
●New York Blower Co., Chicago, Ill.
Peerless Electric Co., Warren, O. (Disc).

● Advertisement in this issue. See Index to Advertisers, page 306.

Perkins & Son, Inc., B. F., Holyoke, Mass.
Phelps Mfg. Co., Little Rock, Ark.
Pritchard & Co., J. F., Kansas City, Mo.
Propellair, Inc., Springfield, O.
Reed Unit-Fans, Inc., New Orleans, La.
Reynolds Electric Co., Chicago, Ill.
Royal Air Conditioning Equipment Co., Alhambra, Cal.
Schwitzer-Cummins Co., Indianapolis, Ind.
Scott-Newcomb, Inc., St. Louis, Mo.
Semco Mfg. Co., Nashville, Tenn.
Shreveport Engineering Co., Inc., Shreveport, La.
Signal Electric Mfg. Co., Menominee, Mich.
●Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
South Bend Air Products Corp., South Bend, Ind.
Sturtevant Co., B. F., Boston, Mass.
Swift Mfg. Co., Detroit, Mich.
Trade-Wind Motorfans, Inc., Los Angeles, Cal.
●Trane Co., The, La Crosse, Wis.
Truflo Fan Co., Harmony, Pa.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Victor Electric Products, Inc., Cincinnati, O.
Viking Air Conditioning Corp., Cleveland, O.
Warren Earl Co., Houston, Tex.
Western Blower Co., Seattle, Wash.
Western Engineering & Mfg. Co., Los Angeles, Cal.
●Wing Mfg. Co., L. J., New York. N. Y.

FEEDERS, CHEMICAL, PROPORTIONING

American Water Softener Co., Philadelphia, Pa.
Black-Sivalls & Bryson, Inc., Kansas City, Mo.
Elgin Softener Corp., Elgin, Ill.
Haering Co., Inc., D. W., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Permutit Co., New York, N. Y.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Syntron Co., Homer City, Pa.
Wallace & Tiernan Co., Inc., Belleville, N. J.

FEEDERS, WATER, HEATING BOILER

Beaton & Cadwell Mfg. Co., New Britain, Conn.
Cissell Mfg. Co., W. M., Louisville, Ky.
Davis Regulator Co., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
●General Controls Co., Glendale, Cal.
Healy Ruff Co., St. Paul, Minn.
Johnson Corp., Three Rivers, Mich.
●Kieley & Mueller, Inc., North Bergen, N. J.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Maid-O'-Mist, Inc., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Nason Co., Detroit, Mich.
Schaub Engineering Co., Fred H., Chicago, Ill.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Strong, Carlisle & Hammond Co., Cleveland, O.
Templeton Mfg. Co., Hyde Park, Mass.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

FEEDWATER HEATERS

See Deaerators

FIBER PACKING

See Packing, Fiber

FILTER GAGES

See Gages, Air Filter

FILTERS, AIR, AUTOMATIC

●Air & Refrigeration Corp., New York, N. Y.
Air-Stream Filter Corp., St. Louis, Mo.
●American Air Filter Co., Inc., Louisville, Ky.
Brauer Supply Co., A. G., St. Louis, Mo.
●Staynew Filter Corp., Rochester, N. Y.

FILTERS, AIR, UNIT, CLEANABLE

Air Filter Engineering Co., Chicago, Ill.
●Air-Maze Corp., Cleveland, O.
Air-Stream Filter Corp., St. Louis, Mo.
●American Air Filter Co., Inc., Louisville, Ky.
Amirton Co., Inc., New York, N. Y.
Annis Air Filters, Glendale, Cal.
Brauer Supply Co., A G., St. Louis, Mo.
Chicago Filter Co., Joliet, Ill.
Coppus Engineering Corp., Worcester, Mass.
Davies Air Filter Corp., New York, N. Y.
Detroit Lubricator Co., Detroit, Mich.
Hugo Mfg. Co., West Duluth, Minn.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kaye & MacDonald, Inc., West Orange, N. J.
Kleenaire Corp., Stevens Point, Wis.
Somers, Inc., H. J., Detroit, Mich.
●Staynew Filter Corp., Rochester, N. Y.
Supreme Air Filter Co., New York, N. Y.
Tuttle Air Filter Co., Inc., Louisville, Ky.
Universal Air Filter Corp., Duluth, Minn.

FILTERS, AIR, UNIT, THROW-AWAY

●American Air Filter Co., Inc., Louisville, Ky.
Amirton Co., Inc., New York, N. Y.
Anderson Products, Inc., Cambridge, Mass.
Blocksom & Co., Michigan City, Ind.
Chicago Filter Co., Joliet, Ill.
Davies Air Filter Corp., New York, N. Y.
Detroit Lubricator Co., Detroit, Mich.
Gehri Co., Tacoma, Wash.
Kleenaire Corp., Stevens Point, Wis.
●Owens-Corning Fiberglas Corp., Toledo, O.
Plymouth Cordage Co., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass. National Sales Agents.
●Research Products Corp., Madison, Wis.
●Staynew Filter Corp., Rochester, N. Y.
Universal Air Filter Corp., Duluth, Minn.
Wilson & Co., Chicago, Ill.

FILTERS, ODOR

See Adsorbers, Odor

FILTERS, PIPE LINE

Adams Co., Inc., R. P., Buffalo, N. Y.
●Alco Valve Co., St. Louis, Mo.
●Automatic Products Co., Milwaukee, Wis.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Cochrane Corp., Philadelphia, Pa.
Cuno Engineering Corp., Meriden, Conn.
Elgin Softener Corp., Elgin, Ill.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
●Fisher Governor Co., Marshalltown, Ia.
General Motors Corp., Moraine Products Div., Dayton, O.
Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
Johnson Corp., Three Rivers, Mich.
Kraissl Co., Inc., The, Hackensack, N. J.
Logan Engineering Co., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Monmouth Products Co., Cleveland, O.
Newark Wire Cloth Co., Newark, N. J.
Norgren Co., C. A., Denver, Colo.
Permutit Co., New York, N. Y.
Refinite Corp., Omaha, Neb.
Rega Mfg. Co., Rochester, N. Y.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Scientific Instrument Co., Detroit, Mich.
●Staynew Filter Corp., Rochester, N. Y.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Trerice Co., Detroit, Mich.
Weatherhead Co., Cleveland, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.

FINNED TUBING

See Tubing, Finned

FIRE PUMPS

See Pumps, Fire

FITTINGS, BLOW PIPE

Allington & Curtis Mfg. Co., Saginaw, Mich.
Aqua-Restor Div., Mayer Mfg. Corp., Brooklyn, N. Y.
Chicago Metal Mfg. Co., Chicago, Ill.
Cincinnati Sheet Metal & Roofing Co., Cincinnati, O.
Day Co., The, Minneapolis, Minn.
Falstrom Co., Passaic, N. J.
Goethel Co., Alfred C., Milwaukee, Wis.
Goethel Sheet Metal Works, Alfred, Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Industrial Sheet Metal Works, Inc., Detroit Mich.
Kirk & Blum Mfg. Co., Cincinnati, O.
Lee & Son Co., Thomas, Cincinnati, O.
Mahon Co., R. C., Detroit, Mich.
Meyer & Bro. Co., F., Peoria, Ill.
Puhl & Hepper Mfg. Co., Inc., St. Louis, Mo.
Schmieg Sheet Metal Works, Detroit, Mich.
●Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Tiffin Eaves Trough Clamp Co., Tiffin, O.
United States Register Co., Battle Creek, Mich.
Western Blower Co., Seattle, Wash.
Young & Bertke Co., Cincinnati, O.

FITTINGS, COPPER TUBE, COMPRESSION

●American Brass Co., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.

● Advertisement in this issue. See Index to Advertisers, page 306.

•Crane Co., Chicago, Ill.
Dresser Mfg. Co., Bradford, Pa.
•Grinnell Co., Inc., Superseal Div., Providence, R. I.
Hays Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Packless Metal Products Corp., New Rochelle, N. Y. (Self-flaring)
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
VibraSeal Corp., Detroit, Mich.

FITTINGS, COPPER TUBE, SOLDER

Acheson Mfg. Co., Rankin, Pa.
•American Brass Co., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
•Crane Co., Chicago, Ill.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
•Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Walworth Co., New York, N. Y. (Brazed)

FITTINGS, DRAINAGE, FIXED AIR BREAK

American Sterilizer Co., Erie, Pa.
Scanlan-Morris Co., Madison, Wis.

FITTINGS, HOT WATER HEATING SYSTEMS, ONE PIPE

•Bell & Gossett Co., Morton Grove, Ill.
Kehm Corp., The, Chicago, Ill.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
•Trane Co., The, La Crosse, Wis.
Triplex Heating Specialty Co., Peru, Ind.

FITTINGS, LINED

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
American Hard Rubber Co., New York, N. Y. (Rubber)
•American Smelting & Refining Co., New York, N. Y.
Goodrich Co., B. F., Akron, O. (Rubber)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead and tin)
National Lead Co., New York, N. Y. (Lead)
Northern Indiana Brass Co., Elkhart, Ind. (Tinned)
Resisto Pipe & Valve Co., East Cambridge, Mass.
United States Rubber Co., New York, N. Y. (Rubber)

FITTINGS, PIPE, BRASS, SOLDER

Acheson Mfg. Co., Rankin, Pa.
•American Brass Co., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
•Crane Co., Chicago, Ill.
Downs-Smith Brass & Copper Co., New York, N. Y.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
•Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Union Metal Works, Inc., Chelsea, Mass.
Walworth Co., New York, N. Y. (Brazed)

FITTINGS, PIPE, BRASS, THREADED

Acheson Mfg. Co., Rankin, Pa.
American Manganese Bronze Co., Philadelphia, Pa.
Belfield Co., H., Philadelphia, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
•Crane Co., Chicago, Ill.
Downs-Smith Brass & Copper Co., New York, N. Y.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
•**Grinnell Co., Inc., Providence, R. I.**
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
New York Brass Fdry., New York, N. Y.
Parker Appliance Co., Cleveland, O.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Phoenix Brass Fittings Corp., Irvington, N. J.
Ross Sprinkler Co., Pasadena, Cal.
Union Metal Wks., Inc., Chelsea, Mass.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

FITTINGS, PIPE, BRASS, WELDING

•Bonney Forge & Tool Wks., Allentown, Pa.
•**Midwest Piping & Supply Co., Inc., St. Louis, Mo.**
•**Tube-Turns, Louisville, Ky.**
Walworth Co., New York, N. Y. (Brazed)

FITTINGS, PIPE, BRONZE, BRAZED

•Crane Co., Chicago, Ill.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Union Metal Works, Inc., Chelsea, Mass.
Walworth Co., New York, N. Y.

FITTINGS, PIPE, CAST IRON, FLANGED

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
•Crane Co., Chicago, Ill.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Eastern Foundry Co., Boyertown, Pa.
Frick Co., Waynesboro, Pa.
•**Grinnell Co., Inc., Providence, R. I.**
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., The, Elmira, N. Y.
Kuhns Bros. Co., Dayton, O.
Lynchburg Foundry Co., Lynchburg, Va.
Malleable Iron Fittings Co., Branford, Conn.
National Valve & Mfg. Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Semler Co., Jeannette, Pa.
Stockham Pipe Fittings Co., Birmingham, Ala.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
United States Pipe & Foundry Co., Burlington, N. J.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

FITTINGS, PIPE, CAST IRON, THREADED

Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
•Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Eastern Foundry Co., Boyertown, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Frick Co., Waynesboro, Pa.
Grabler Mfg. Co., Cleveland, O.
•**Grinnell Co., Inc., Providence, R. I.**
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kuhns Bros. Co., Dayton, O.
Malleable Iron Fittings Co., Branford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ravena Iron Co., Ravena, N. Y.
Semler Co., Jeannette, Pa.
Somerville Iron Works, Somerville, N. J.
Stockham Pipe Fittings Co., Birmingham, Ala.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

FITTINGS, PIPE, LEAD

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
•American Smelting & Refining Co., New York, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lead Lined Iron Pipe Co., Wakefield, Mass.
Lissberger & Son., Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.

FITTINGS, PIPE, MALLEABLE

•Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
•Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Malleable Iron Fittings Co., Branford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Stockham Pipe Fittings Co., Birmingham, Ala.
Victaulic Co. of America, New York, N. Y.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

FITTINGS, PIPE, NICKEL AND NICKEL ALLOY

American Manganese Bronze Co., Philadelphia, Pa.
•Crane Co., Chicago, Ill.
Duriron Co., Inc., Dayton, O.
Hasco Valve & Machine Co., Milwaukee, Wis.
•International Nickel Co., New York, N. Y.
Parker Appliance Co., Cleveland, O.
•**Tube-Turns, Louisville, Ky.**

FITTINGS, PIPE, PLASTIC

Acadia Synthetic Products Div., Western Felt Works, Chicago, Ill.
American Hard Rubber Co., New York, N. Y.
Hodgman Rubber Co., Framingham, Mass.
Mills Corp., Elmer E., Chicago, Ill.
North Penn Co., New York, N. Y.
United States Stoneware Co., New York, N. Y.

• Advertisement in this issue. See Index to Advertisers, page 306.

FITTINGS, PIPE, STEEL, FLANGED

Alloy Steel Products Co., Linden, N. J. (Stainless steel).
•American Rolling Mill Co., The, Middletown, O.
Clow & Sons, James B., Chicago, Ill.
•Crane Co., Chicago, Ill.
Frick Co., Waynesboro, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis. (Stainless steel only)
National Valve & Mfg. Co., Pittsburgh, Pa.
•**Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.**
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Semet-Solvay Engrg. Corp., New York, N. Y.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
•**Watson-Stillman Co., Roselle, N. J.**

FITTINGS, PIPE, STEEL, FORGED, THREADED

Catawissa Valve & Fittings Co., Catawissa, Pa.
•Crane Co., Chicago, Ill.
•**Grinnell Co., Inc., Providence, R. I.**
•Henry Valve Co., Chicago, Ill.
Larkin Packer Co., St. Louis, Mo.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
•**Watson-Stillman Co., Roselle, N. J.**

FITTINGS, PIPE, STEEL, SOCKET WELD

Catawissa Valve & Fittings Co., Catawissa, Pa.
•Crane Co., Chicago, Ill.
•**Grinnell Co., Inc., Providence, R. I.**
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
•**Watson-Stillman Co., Roselle, N. J.**

FITTINGS, PIPE, STEEL, THREADED

Alloy Steel Products Co., Linden, N. J. (Stainless steel).
Catawissa Valve & Fittings Co., Catawissa, Pa.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
•Crane Co., Chicago, Ill.
Frick Co., Waynesboro, Pa.
Harrisburg Steel Corp., Harrisburg, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis. (Stainless steel only)
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
•**Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.**
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
•**Watson-Stillman Co., Roselle, N. J.**

FITTINGS, PIPE, STEEL, WELDING

•American Rolling Mill Co., The, Middletown, O.
•Bonney Forge & Tool Wks., Allentown, Pa.
Catawissa Valve & Fittings Co., Catawissa, Pa.
•Crane Co., Chicago, Ill.
•**Grinnell Co., Inc., Providence, R. I.**
Larkin Packer Co., St. Louis, Mo.
•**Midwest Piping & Supply Co., Inc., St. Louis, Mo.**
National Valve & Mfg. Co., Pittsburgh, Pa.
Oil Well Supply Co., Oil City, Pa.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Semet-Solvay Engineering Corp., New York, N. Y.
•**Taylor Forge & Pipe Wks., Chicago, Ill.**
•**Tube-Turns, Louisville, Ky.**
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
Wedge Protectors, Inc., Cleveland, O. (Chill rings)

FITTINGS, PIPE, WROUGHT IRON, WELDING

•Bonney Forge & Tool Wks., Allentown, Pa.
•**Grinnell Co., Inc., Providence, R. I.**
•**Midwest Piping & Supply Co., Inc., St. Louis, Mo.**
National Valve & Mfg. Co., Pittsburgh, Pa.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
•**Taylor Forge & Pipe Wks., Chicago, Ill.**
•**Tube-Turns, Louisville, Ky.**

FITTINGS, REFRIGERATION

American Injector Co., Detroit, Mich.
•**Baker Ice Machine Co., Inc., Omaha, Nebr.**
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
•Crane Co., Chicago, Ill.
Downs-Smith Brass & Copper Co., New York, N. Y.
Frick Co., Waynesboro, Pa.
•Henry Valve Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kerotest Mfg. Co., Pittsburgh, Pa.
•**Mueller Brass Co., Port Huron, Mich.**
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Superior Valve and Fittings Co., Pittsburgh, Pa.
Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
•**Watson-Stillman Co., Roselle, N. J.**
Weatherhead Co., Cleveland, O.
Wittenmeier Machinery Co., Chicago, Ill.
•Worthington Pump & Machinery Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.
X L Refrigerating Co., Inc., Chicago, Ill.
York Ice Machinery Corp., York, Pa.

FLANGE BOLTS

See Bolts and Studs, Flange

FLANGES, PIPE

•American Rolling Mill Co., The, Middletown, O.
•**Baker Ice Machine Co., Inc., Omaha, Nebr.**
Chase Brass & Copper Co., Waterbury, Conn.
Clow & Sons, James B., Chicago, Ill.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
•Crane Co., Chicago, Ill.
Dart Mfg. Co., E. M., Providence, R. I.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
•Flori Pipe Co., The, St. Louis, Mo.
Grabler Mfg. Co., Cleveland, O.
•**Grinnell Co., Inc., Providence, R. I.**
Harrisburg Steel Corp., Harrisburg, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis. (Stainless steel only)
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kopperman & Sons, Joseph, Philadelphia, Pa.
Kuhns Bros. Co., Dayton, O.
Limbert & Co., Geo. B, Chicago, Ill.
Lynchburg Foundry Co., Lynchburg, Va.
•**Midwest Piping & Supply Co., Inc., St. Louis, Mo.**
National Valve & Mfg. Co., Pittsburgh, Pa.
Naylor Pipe Co., Chicago, Ill.
Newman Brothers, Inc., Cincinnati, O.
Pennsylvania Forge Co., Philadelphia, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
Ravena Iron Co., Ravena, N. Y.
Rhode Island Fittings Co., Hillsgrove, R. I.
Semet-Solvay Engineering Corp., New York, N. Y.
Semler Co., Jeannette, Pa.
Steel Improvement & Forge Co., Cleveland, O.
Stockham Pipe Fittings Co., Birmingham, Ala.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
•**Taylor Forge & Pipe Wks., Chicago, Ill.**
•**Tube-Turns, Louisville, Ky.**
Union Metal Works, Inc., Chelsea, Mass.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
Warren Foundry & Pipe Corp., New York, N. Y.

FLEXIBLE COUPLINGS

See Couplings, Flexible

FLEXIBLE DUCT CONNECTIONS

See Connections, Duct, Flexible

FLEXIBLE METAL HOSE

See Hose, Metal, for Eliminating Compressor Vibration

FLOAT SWITCHES

See Switches, Float

FLOAT VALVES

See Valves, Float

FLOATS, STEAM TRAP, ETC.

Clark Controller Co., Cleveland, O.
Cryer Trap & Valve Co., Inc., New York, N. Y.
Harris & Co., Arthur, Chicago, Ill.
Hercules Float Wks., Springfield, Mass.
•Hoffman Specialty Co., Indianapolis, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
•Kieley & Mueller, Inc., North Bergen, N. J.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Naugatuck Mfg. Co., Union City, Conn.
Nicholson & Co., W. H., Wilkes-Barre, Pa.

• Advertisement in this issue. See Index to Advertisers, page 306.

●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Reichert Float & Mfg. Co., Toledo, O.
Reliance Gauge Column Co., Cleveland, O.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Sterling, Inc., Milwaukee, Wis.
Strong, Carlisle & Hammond Co., Cleveland, O.
Templeton Mfg. Co., Hyde Park, Mass.
●Trane Co., The, La Crosse, Wis.
Vapor Specialty Co., New York, N. Y.
Watson & McDaniel Co., Philadelphia, Pa.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

FLOOR AND CEILING PLATES

See Plates, Floor and Ceiling

FLOW CONTROL VALVES

See Valves, Flow Control

FLOW METERS

See Meters, Flow

FLOW SWITCHES

See Switches, Flow

FORGED STEEL VALVES

See Valves, Forged Steel

FURNACES, WARM AIR, FOR INDUSTRIAL AND LARGE BUILDING HEATING

●Airtherm Mfg. Co., St. Louis, Mo.
American Foundry & Furnace Co., Bloomington, Ill.
Arcweld Mfg. Co., Inc., Seattle, Wash.
Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Beck Engineering Combustion Kompany, St. Louis, Mo.
Bryant Heater Co., The, Cleveland, O.
Campbell Heating Co., Des Moines, Ia.
Campbell Heating Co., E. K., Kansas City, Mo.
Conco Corp., Div. of H. D. Conkey & Co., Mendota, Ill.
Henry Furnace & Foundry Co., Cleveland, O.
Jackson & Church Co., Saginaw, Mich.
Lee Engineering Co., Youngstown, O.
Lennox Furnace Co., Marshalltown, Ia., Syracuse, N. Y., and Columbus, O.
Lyon, Conklin & Co., Inc., Baltimore, Md.
Magirl Foundry & Furnace Wks., P. H., Bloomington, Ill.
Majestic Co., Huntington, Ind.
Mayflower Air-Conditioners, Inc., St. Paul, Minn.
McCann Furnace Co., Cleveland, O.
McLouth Air Conditioning Corp., Lansing, Mich.
McPherson Furnace & Supply Co., Portland, Ore.
Meyer Furnace Co., The, Peoria, Ill.
Moncrief Furnace Co., Atlanta, Ga.
Montag Stove & Furnace Wks., Portland, Ore.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Heating Co., Minneapolis, Minn.
National Mfg. & Engineering Co., Detroit, Mich.
●New York Blower Co., Chicago, Ill.
Palmer Mfg. Corp., Phoenix, Ariz.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Rosebraugh Co., W. W., Salem, Ore.
Sonner Burner Co., Winfield, Kans.
Stainless & Steel Products Co., St. Paul, Minn.
Surface Combustion, Toledo, O.
XXth Century Heating & Ventilating Co., Akron, O.
Western Furnaces, Inc., Tacoma, Wash.
●Zink Co., John, Tulsa, Okla.

GAGE GLASSES

See Glasses, Gage

GAGE TESTERS

See Testers, Gage, Dead Weight

GAGES, AIR FILTER

Air Filter Engineering Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Ellison Draft Gage Co., Chicago, Ill.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●Hays Corp., Michigan City, Ind.
Herbusch Corp., The, St. Louis, Mo. (Warning device)
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Meriam Co., The, Cleveland, O.

GAGES, INDICATING, DRAFT

Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Ellison Draft Gage Co., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Hotstream Heater Co., Cleveland, O.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Preferred Utilities Mfg. Co., New York, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Uehling Instrument Co., Paterson, N. J.

GAGES, INDICATING, PRESSURE

Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Belfield Co., H., Philadelphia, Pa.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Certified Gauge & Instrument Corp., Long Island City, N. Y.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Brass & Malleable Wks., Detroit, Mich.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
●Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Lonergan Co., J. E., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
●Mercoid Corp., Chicago, Ill.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Mouat Vapor Heating Co., The, Cleveland, O.
Norgren Co., C. A., Denver, Colo.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., New York, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Rochester Mfg. Co., Rochester, N. Y.
Scientific Instrument Co., Detroit, Mich.
Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
●Trane Co., The, La Crosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Triplex Heating Specialty Co., Peru, Ind.
Uehling Instrument Co., Paterson, N. J.
●United States Gauge Co., New York, N. Y.
Wheelco Instruments Co., Chicago, Ill.

GAGES, INDICATING, VACUUM

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Belfield Co., H., Philadelphia, Pa.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Certified Gauge & Instrument Corp., Long Island City, N. Y.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
●Hays Corp., Michigan City, Ind.
●Hoffman Specialty Co., Indianapolis, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Lonergan Co., J. E., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
●Mercoid Corp., Chicago, Ill.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Mouat Vapor Heating Co., The, Cleveland, O.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., New York, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Rochester Mfg. Co., Rochester, N. Y.
Scientific Instrument Co., Detroit, Mich.

● Advertisement in this issue. See Index to Advertisers, page 306.

Taylor Instrument Companies, Rochester, N. Y.
●Trane Co., The, La Crosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Uehling Instrument Co., Paterson, N. J.
●United States Gauge Co., New York, N. Y.

GAGES, LIQUID LEVEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
American Injector Co., Detroit, Mich.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Boston Auto Gage Co., Pittsfield, Mass.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
Caldwell Co., W. E., Louisville, Ky.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Lubricator Co., Detroit, Mich.
Diamond Power Specialty Corp., Detroit, Mich.
Foxboro Co.. Foxboro, Mass.
Frick Co., Waynesboro, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Keckley Co., O. C., Chicago, Ill.
King Engineering Corp., Ann Arbor, Mich.
Klingerit, Inc., New York, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Liquidometer Corp., Long Island City. N. Y.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Nason Co., Detroit, Mich.
Penberthy Injector Co., Detroit, Mich.
Petrometer Corp., Long Island City, N. Y.
Powell Co., Wm., Cincinnati, O.
Reliance Gauge Column Co., Cleveland, O.
Republic Flow Meters Co., Chicago, Ill.
Rochester Mfg. Co., Rochester, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Techtmann Industries, Inc., Milwaukee, Wis.
Uehling Instrument Co., Paterson, N. J.
●United States Gauge Co., New York, N. Y.
Viking Pump Co., Cedar Falls, Ia.
Williams Gauge Co., Pittsburgh, Pa. (Water)
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

GALVANIZED SHEETS

See Sheets, Steel, Galvanized

GALVANNEALED SHEETS

See Sheets, Steel, Galvannealed

GAS BURNERS

See Burners, Gas

GAS ENGINES

See Engines, Gas

GAS FIRED RADIATORS

See Radiators, Gas Fired

GAS PRESSURE REGULATORS

See Regulators, Pressure, Gas

GAS VOLUME METERS

See Meters, Volume, Air and Gas

GASKETS

Akron Metallic Gasket Co., Akron, O. (Metal & metal asbestos)
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
●American Smelting & Refining Co., New York, N. Y.
Anchor Packing Co., Philadelphia, Pa. (Asbestos)
●Armstrong Cork Co., Lancaster, Pa. (Cork & cork composition)
Azor Corp., Irvington, N. J. (Spiral wound)
Belmont Smelting & Refining Works, Inc., Brooklyn, N. Y. (Lead)
Butterworth, Jr., B. T., New Canaan, Conn. (Cork)
Chicago-Wilcox Mfg. Co., Chicago, Ill.
Clow & Sons, James B., Chicago, Ill.
Continental Diamond Fibre Co., Newark, Del.
Continental Rubber Wks., Erie, Pa.
●Crane Co., Chicago, Ill.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc. New York, N. Y. (Asbestos)
Durabla Mfg. Co., New York, N. Y. (Asbestos fibre)
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Endura Mfg. Corp., Quakertown, Pa. (Paper, fibre)
Excelsior Leather Washer Mfg. Co., Rockford, Ill.
Felt Products Mfg. Co. Chicago, Ill. (Heat and oil resisting)
Felters Co., Inc., Boston, Mass.
Flexatalic Gasket Co., Camden, N. J. (Metal, asbestos)
Flexlock Corp., Akron, O.
Frick Co., Waynesboro, Pa.
Garlock Packing Co., Palmyra, N. Y. (Rubber, asbestos, fibre, semi-metallic)
Gatke Corp., Chicago, Ill.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Goodrich Co., B. F., Akron, O.
●Grant Wilson, Inc., Chicago, Ill. (Asbestos)
Graton & Knight Co., Worcester, Mass. (Leather)
Greene, Tweed & Co., New York, N. Y.
Houghton & Co., E. F., Philadelphia, Pa. (Leather)
●Jenkins Bros., New York, N. Y. (Ring asbestos or rubber sheet)
●Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Klingerit, Inc., New York, N. Y.
Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
Manhattan Rubber Mfg., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Metallo Gasket Co., New Brunswick, N. J. (Metal, metal asbestos)
●Mitchell & Smith, Inc., Detroit, Mich. (Cork)
National Engineering Products, Inc., Washington, D. C. (Plastic)
National Lead Co., New York, N. Y.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Quaker Rubber Corp., Philadelphia, Pa.
Ruberoid Co., New York, N. Y. (Asbestos)
Schieren Co., Chas. A., New York, N. Y.
Smooth-On Mfg. Co., Jersey City, N. J. (Corrugated iron)
Steel Improvement & Forge Co., Cleveland, O.
Stokes Rubber Co., Jos., Trenton, N. J. (Hard rubber)
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
●Union Asbestos & Rubber Co., Cicero, Ill.
United States Rubber Co., New York, N. Y. (Rubber, asbestos)
United States Stoneware Co., New York, N. Y.
Werner Co., Inc., R. D., New York, N. Y.
Western Felt Wks., Chicago, Ill. (Felt)
●Wilson, Inc., Grant, Chicago, Ill. (Asbestos)

GATE VALVES

See Valves, Gate

GATES, BLAST

●Airtherm Mfg Co. St. Louis, Mo.
Allington & Curtis Mfg. Co., Saginaw, Mich.
Berger Bros. Co., Philadelphia, Pa.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
Day Co., The, Minneapolis, Minn.
Goethel Co., Alfred C., Milwaukee, Wis.
Goethel Sheet Metal Works, Alfred, Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Kirk & Blum Mfg. Co., Cincinnati, O.
Maysteel Products, Inc., Mayville, Wis.
Puhl & Hepper Mfg. Co., Inc., St. Louis, Mo.
●R-S Products Corp., Philadelphia, Pa.
Spencer Turbine Co., Hartford, Conn.
Sturtevant Co., B. F., Boston, Mass.
Western Blower Co., Seattle, Wash.

GLASS PIPE

See Pipe, Glass

GLASSES, GAGE

Bache, Semon & Co., New York, N. Y.
Corning Glass Works, Corning, N. Y.
●Crane Co., Chicago, Ill.
Durabla Mfg. Co., New York, N. Y.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
●Jenkins Bros., New York, N. Y.
Klingerit, Inc., New York, N. Y.
Libbey-Owens Ford Glass Co., Toledo, O.
Powell Co., Wm., Cincinnati, O.

GLASSES, SIGHT, FOR PIPE LINES

Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Cochrane Corp., Philadelphia, Pa.
Corning Glass Works, Corning, N. Y.
Libbey-Owens Ford Glass Co., Toledo, O.
Weatherhead Co., Cleveland, O.

GLOBE VALVES

See Valves, Globe

● Advertisement in this issue. See Index to Advertisers, page 306.

GOVERNORS, PUMP

Atlas Valve Co., Inc., Newark, N. J.
Boylston Steam Specialty Co., Chicago, Ill.
Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Gardner-Denver Co., Quincy, Ill.
Hagan Corp., Pittsburgh, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Keckley Co., O. C., Chicago, Ill.
●Kieley & Mueller, Inc., North Bergen, N. J.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Northern Equipment Co., Erie, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Sampsel Time Control, Inc., Spring Valley, Ill.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

GRILLES

See also Diffusers, and Registers

Acme Tin Plate & Roofing Supply Co., Philadelphia, Pa.
Air Control Products, Inc., Coopersville, Mich.
Air Devices, Inc., New York, N. Y.
AirO-Fin Register Co., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
●Auer Register Co., Cleveland, O.
●Barber-Colman Co., Rockford, Ill.
Beckley Perforating Co., Garwood, N. J.
Best Register Co., Milwaukee, Wis.
Central Wire & Iron Works, Des Moines, Ia.
Char-Gale Mfg. Co., Minneapolis, Minn.
Crown Iron Works, Minneapolis, Minn.
Davies Air Filter Corp., New York, N. Y.
Decatur Iron & Steel Co., Decatur, Ala.
Diamond Mfg. Co., Wyoming, Pa.
Empire Ventilation Equipment Co., Long Island City, N. Y.
Erdle Perforating Co., Rochester, N. Y.
Gillian Mfg. Co., Detroit, Mich.
Harrington & King Perforating Co., Chicago, Ill.
Hart & Cooley Mfg. Co., Holland, Mich.
Hendrick Mfg. Co., Carbondale, Pa.
Independent Register Co., Cleveland, O.
Jamieson Mfg. Co., Dallas, Tex.
Johnston & Chapman Co., Chicago, Ill.
Lamneck Products, Inc., Middletown, O.
Lockjoint Wood Products Co., Wichita, Kans. (Wood)
Manhattan Perforated Metal Co., Inc., Long Island City, N. Y.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Mundt & Sons, Charles, Jersey City, N. J.
Newman Brothers, Inc., Cincinnati, O.
Register & Grille Mfg. Co., Brooklyn, N. Y.
Reliable Perforating Co., Chicago, Ill.
Roberts-Hamilton Co., Minneapolis, Minn.
Rock Island Register Co., Rock Island, Ill.
Schoedinger, F. O., Columbus, O.
●Standard Stamping & Perforating Co., Chicago, Ill.
Stewart Mfg. Co., Orange, N. J.
●Tuttle & Bailey, Inc., New Britain, Conn.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
United States Register Co., Battle Creek, Mich.
Utility Fan Corp., Los Angeles, Cal.
Waterloo Register Co., Waterloo, Ia.
Western Wire & Iron Works, Inc., Chicago, Ill.
Wickwire Spencer Steel Co., New York, N. Y.
Wooster Art Wood, Inc., Wooster, O.

GUNS AND POTS, SMOKE AND SMUDGE, FOR TESTING AIR MOVEMENT

Hill, E. Vernon, Chicago, Ill.
Newman Co., Inc., I. C., New York, N. Y.
Pains Fireworks Display Co., New York, N. Y.

HAND SHEARS

See Shears and Snips, Hand

HANGERS OR BRACKETS, RADIATOR

American Foundry & Furnace Co., Bloomington, Ill.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Bell & Gossett Co., Morton Grove, Ill.
Carpenter & Paterson, Inc., East Boston, Mass.
Carty & Moore Engineering Co., Detroit, Mich.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Hartmann Co., Chas., Brooklyn, N. Y.
Healy Ruff Co., St. Paul, Minn.
Inland Mfg. Co., Chicago, Ill. (Unit heater hangers)
Jennison Co., Fitchburg, Mass. (Adjustable radiator foot rest)
McAlear Mfg. Co., Chicago, Ill.
National Radiator Co., The, Johnstown, Pa.
Paine Co., Chicago, Ill.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
United States Radiator Corp., Detroit, Mich.
Western Hanger Co., San Francisco, Cal.

HANGERS AND SUPPORTS, PIPE

Acme Tin Plate & Roofing Supply Co., Philadelphia, Pa.
●American District Steam Co., North Tonawanda, N. Y.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Carpenter & Paterson, Inc., East Boston, Mass.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Farley Sleeve & Hanger Co., Cleveland, O.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
●Flori Pipe Co., The, St. Louis, Mo.
Frick Co., Waynesboro, Pa.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Jarecki Mfg. Co., Erie, Pa.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Valve & Mfg. Co., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
Ravena Iron Co., Ravena, N. Y.
●Reznor Mfg. Co., Mercer, Pa.
●Ric-wiL Co., Cleveland, O. (Underground)
Rockwood Sprinkler Co., Worcester, Mass.
Roessing Mfg. Co., Pittsburgh, Pa.
Semler Co., Jeannette, Pa.
Truscon Steel Co., Youngstown, O.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburg, Pa.
Western Wire Products Co., St. Louis, Mo.

HARD RUBBER PIPE

See Pipe, Hard Rubber

HEADERS, WELDED

●Acme Industries, Inc., Jackson, Mich.
American Locomotive Co., Alco Products Div., New York, N. Y.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Biggs Boiler Works Co., E. Akron, O.
Chicago Nipple Mfg. Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
●Crane Co., Chicago, Ill.
Downingtown Iron Works, Downingtown, Pa.
●Flori Pipe Co., The, St. Louis, Mo.
Frick Co., Waynesboro, Pa.
●Grinnell Co., Inc., Providence, R. I.
International Engineering Wks., Inc., Framingham, Mass.
Kellogg Co., M. W., The, New York, N. Y.
Kopperman & Sons, Joseph, Philadelphia, Pa.
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden & Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
National Valve & Mfg. Co., Pittsburgh, Pa.
Naylor Pipe Co., Chicago, Ill.
Ohio Pipe Bending & Mach. Co., Cleveland, O.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
Pittsburgh Pipe Coil & Bending Co., Etna, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
Rempe Co., Chicago, Ill.
Richmond Engineering Co., Inc., Richmond, Va.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
Shaw Co., Benjamin F., Wilmington, Del.
Shaw-Kendall Engineering Co., Toledo, O.
Walworth Co., New York, N. Y.
Zallea Brothers & Johnson, Wilmington, Del.

● Advertisement in this issue. See Index to Advertisers, page 306.

HEADS, EXHAUST, FOR PIPE LINES

Aeolus Dickinson, Chicago, Ill.
Cochrane Corp., Philadelphia, Pa.
Hoppes Mfg. Co., Springfield, O.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Wright-Austin Co., Detroit, Mich.

HEADS, SPRINKLER

Binks Mfg. Co., Chicago, Ill.
Cleghorn Co., Boston, Mass.
●Grinnell Co., Inc., Providence, R. I.
●Hodgman Mfg. Co., Taunton, Mass.
Northern Indiana Brass Co., Elkhart, Ind.
Raisler Corp., Grimes Sprinkler Div., New York, N. Y.
Rockwood Sprinkler Co., Worcester, Mass.

HEAT EXCHANGERS

See Chillers, Water; Condensers, Refrigerating; Surface, Cooling; Surface, Heating

HEATERS, AIR, DIRECT FIRED

Air Devices, Inc., New York, N. Y.
●Airtherm Mfg. Co., St. Louis, Mo.
American Furnace Co., St. Louis, Mo.
Campbell Heating Co., Des Moines, Ia.
Century Engineering Corp., Cedar Rapids, Ia.
Despatch Oven Co., Minneapolis, Minn.
●Dravo Corp., Pittsburgh, Pa.
Faraday Engineering Co., Boston, Mass.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Jackson & Church Co., Saginaw, Mich.
Lee Engineering Co., Youngstown, O.
Magirl Foundry & Furnace Wks., P. H., Bloomington, Ill.
McCann Furnace Co., Cleveland, O.
National Heating Co., Minneapolis, Minn.
National Mfg. & Engineering Co., Detroit, Mich.
Nelson Co., Detroit, Mich.
●New York Blower Co., Chicago, Ill.
Pacific Airmax Corp., Huntington Park, Cal.
Palmer Mfg. Corp., Phoenix, Ariz.
Ross Engineering Corp., J. O., New York, N. Y.
Smith, Inc., James Campbell, Cleveland, O.
Sonner Burner Co., Winfield, Kans.
Supreme Heater & Ventilating Corp., St. Louis, Mo.
Surface Combustion, Toledo, O.
Williams, Inc., F. C., Dearborn, Mich.

HEATERS, DUCT, ELECTRIC

Consolidated Car-Heating Co., Inc., Albany, N. Y.
Despatch Oven Co., Minneapolis, Minn.
●General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Camden, N. J.
Trent Co., Harold E., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., Mansfield, O.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, DUCT, GAS

Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Bryant Heater Co., The, Cleveland, O.
Electrogas Furnace Co., San Francisco, Cal.
Pacific Airmax Corp., Huntington Park, Cal.
Palmer Mfg. Corp., Phoenix, Ariz.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
●Reznor Mfg. Co., Mercer, Pa.
Royal Air Conditioning Equipment Co., Alhambra, Cal.
Surface Combustion, Toledo, O.
Utility Fan Corp., Los Angeles, Cal.

HEATERS, FEEDWATER

See Deaerators

HEATERS, INDIRECT, SUBMERGED

●Bell & Gossett Co., Morton Grove, Ill.
Frank Heaters, Inc., Paterson, N. J.
General Fittings Co., Providence, R. I.
Richmond Engineering Co., Inc., Richmond, Va.
Standard Heater & Oil Equipment Co., Jersey City, N. J.
Taco Heaters, Inc., New York, N. Y.

HEATERS, STRIP AND IMMERSION, ELECTRIC

American Instrument Co., Silver Spring, Md.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Cutler-Hammer, Inc., Milwaukee, Wis.
Electric Arc, Inc., Newark, N. J.
●General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Camden, N. J.
Red Spot Electric Co., Tacoma, Wash.
Swoboda, Inc., H. O., New Brighton, Pa.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Danvers, Mass.
Westinghouse Electric & Mfg. Co., Mansfield, O.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, UNIT, ELECTRIC HEATING ELEMENT

●Burnham Boiler Corp., Irvington, N. Y. (Radiator)
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Electric Air Heater Co., Div. American Foundry Equipment Co., Mishawaka, Ind.
●General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Camden, N. J.
Ilg Electric Ventilating Co., Chicago, Ill.
Red Spot Electric Co., Tacoma, Wash.
Samson-United Corp., Rochester, N. Y.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Danvers, Mass.
Warren Electric Appliance Co., Warren, Pa.
Westinghouse Electric & Mfg. Co., Mansfield, O.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, UNIT, GAS FIRED

Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Automatic Gas Equipment Co., Pittsburgh, Pa.
Bryant Heater Co., The, Cleveland, O.
Campbell Heating Co., E. K., Kansas City, Mo.
Clow & Sons, James B., Chicago, Ill.
Continental Stove Corp., Ironton, O.
General Gas Light Co., Kalamazoo, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
Lee Engineering Co., Youngstown, O.
McCann Furnace Co., Cleveland, O.
●McCord Radiator & Mfg. Co., Detroit, Mich.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Pacific Airmax Corp., Huntington Park, Cal.
Palmer Mfg. Corp., Phoenix, Ariz.
●Reznor Mfg. Co., Mercer, Pa.
Surface Combustion, Toledo, O.
Utility Fan Corp., Los Angeles, Cal.

HEATERS, UNIT, OIL FIRED

●Dravo Corp., Pittsburgh, Pa.
Sawyer-Hare Furnace Co., Detroit, Mich.

HEATERS, UNIT, STEAM AND HOT WATER

●Airtherm Mfg. Co., St. Louis, Mo.
American Blower Corp., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Beacon-Morris Corp., Boston, Mass.
Berns Specialty Mfg. Co., Chicago, Ill.
Bishop & Babcock Mfg. Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
●Burnham Boiler Corp., Irvington, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
Carrier Corp., Syracuse, N. Y.
Champion Unit Heater Co., Chicago, Ill.
●Clarage Fan Co., Kalamazoo, Mich.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Dunham Co., C. A., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●Grinnell Co., Inc., Providence, R. I.
Hartzell Propeller Fan Co., Piqua, O.
Harvey-Whipple, Inc., Springfield, Mass.
Hastings Air Conditioning Co., Hastings, Neb.
Ilg Electric Ventilating Co., Chicago, Ill.
Industrial Mfg. & Engrg. Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Johnson Fan & Blower Corp., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Kisco Boiler & Engineering Co., St. Louis, Mo.
●Kramer Trenton Co., Trenton, N. J.
●McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
Murray Iron Wks. Co., Burlington, Ia.
●Murray Mfg. Co., D. J., Wausau, Wis.
National Radiator Co., The, Johnstown, Pa.
Nelson Corp., Herman, Moline, Ill.
●Nesbitt, Inc., John J., Philadelphia, Pa.
●New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Refrigeration Economics Co., Inc., Canton, O.
Richmond Engineering Co., Inc., Richmond, Va.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
Semco Mfg. Co., Nashville, Tenn.
●Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Tenney Engineering, Inc., Bloomfield, N. J.
●Trane Co., The, La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
●Webster & Co., Warren, Camden, N. J.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.
●Young Radiator Co., Racine, Wis.

● Advertisement in this issue. See Index to Advertisers, page 306.

HEATERS, WATER, CAST IRON, COAL FIRED

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Burnham Boiler Corp., Irvington, N. Y.
Cleghorn Co., Boston, Mass.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Glore Sales Corp., Evins F., New York, N. Y.
International Heater Co., Utica, N. Y.
National Radiator Co., The, Johnstown, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Schwitzer-Cummins Co., Indianapolis, Ind.
●Smith Co., Inc., H. B., The, Westfield, Mass.
Spencer Heater Div., The Aviation Corp., Williamsport, Pa.
Thatcher Furnace Co., Garwood, N. J.
United States Radiator Corp., Detroit, Mich.
Weil-McLain Co., Chicago, Ill.

HEATERS, WATER, ELECTRIC

●Bell & Gossett Co., Morton Grove, Ill.
Edison General Electric Appliance Co., Inc., Chicago, Ill.
Hotstream Heater Co., Cleveland, O.
Hynes Electric Heating Co., Camden, N. J.
Trent Co., Harold E., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., Mansfield, O.

HEATERS, WATER, GAS FIRED

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Bryant Heater Co., The, Cleveland, O.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Gerstein & Cooper Co., South Boston, Mass.
Handley Brown Heater Co., Jackson, Mich.
Hotstream Heater Co., Cleveland, O.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Co., S. T., Oakland, Cal.
Montgomery Bros., San Francisco, Cal.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Radiator Co., The, Johnstown, Pa.
Pacific Airmax Corp., Huntington Park, Cal.
Pittsburgh Water Heater Co., Pittsburgh, Pa.
Richmond Radiator Co., Uniontown, Pa.
Rotary Mfg. Co., Los Angeles, Cal.
Ruud Mfg. Co., Pittsburgh, Pa.
Sellers Engineering Co., Chicago, Ill.
Sonner Burner Co., Winfield, Kans.
Stainless & Steel Products Co., St. Paul, Minn.
United States Radiator Corp., Detroit, Mich.

HEATERS, WATER, INDIRECT

Akwa Heaters, Inc., New York, N. Y.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Bell & Gossett Co., Morton Grove, Ill.
Bryan Steam Corp., Peru, Ind.
Davis Engineering Corp., Elizabeth, N. J.
Downingtown Iron Works, Downingtown, Pa.
Ferguson & Lange Foundry Co., Chicago, Ill.
Frank Heaters, Inc., Paterson, N. J.
General Fittings Co., Providence, R. I.
Hotstream Heater Co., Cleveland, O.
Kehm Corp., The, Chicago, Ill.
●Little Mfg. Co., M. S., Hartford, Conn.
Marion Machine Foundry & Supply Co., Marion, Ind.
Sims Co., Erie, Pa.
Standard Heater & Oil Equipment Co., Jersey City, N. J.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Heating Specialty Co., Peru, Ind.
Vapor Car Heating Co., Inc., Chicago, Ill.

HEATERS, WATER, INDIRECT, COMBINATION TANK AND TANKLESS

●Bell & Gossett Co., Morton Grove, Ill.
●Burnham Boiler Corp., Irvington, N. Y.
Richmond Engineering Co., Inc., Richmond, Va.
Standard Heater & Oil Equipment Co., Jersey City, N. J.

HEATERS, WATER, OIL FIRED

Air Devices, Inc., New York, N. Y.
Bethlehem Foundry & Machine Co., Bethlehem, Pa.
Century Engineering Corp., Cedar Rapids, Ia.
Conco Corp., Div. of H. D. Conkey & Co., Mendota, Ill.
Delco Appliance Div., General Motors Corp., Rochester, N. Y.
Electrol, Inc., Clifton, N. J.
Gerstein & Cooper Co., South Boston, Mass.
Glore Sales Corp., Evins F., New York, N. Y.
Hotstream Heater Co., Cleveland, O.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Co., S. T., Oakland, Cal.
Littleford Bros., Cincinnati, O.
Nu-Way Corp., Rock Island, Ill.
Pacific Steel Boiler Div., United States Radiator Corp., Detroit, Mich.
Pan-American Engineering Co., Berkeley, Cal.
●Petroleum Heat & Power Co, Stamford, Conn.
Preferred Utilities Mfg. Corp., New York, N. Y.
Ray Oil Burner Co., San Francisco, Cal.
Reif-Rexoil, Inc., Buffalo, N. Y.
Scott-Newcomb, Inc., St. Louis, Mo.
●Smith Co., Inc., H. B., The, Westfield, Mass.
Spencer Heater Div., The Aviation Corp., Williamsport, Pa.
Stainless & Steel Products Co., St. Paul, Minn.
United States Radiator Corp., Detroit, Mich.
Vapor Car Heating Co., Inc., Chicago, Ill.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
York Oil Burner Co., Inc., York, Pa.

HEATERS, WATER, STEAM, INSTANTANEOUS

Akwa Heaters, Inc., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
American Locomotive Co., Alco Products Div., New York, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Davis Engineering Corp., Elizabeth, N. J.
Downingtown Iron Works, Downingtown, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Frank Heaters, Inc., Paterson, N. J.
General Fittings Co., Providence, R. I.
General Furnaces Corp., New York, N. Y.
Gerstein & Cooper Co., South Boston, Mass.
Hasco Valve & Machine Co., Milwaukee, Wis.
Heat Transfer Products, Inc., New York, N. Y.
Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
Johnson Corp., Three Rivers, Mich.
Marion Machine Foundry & Supply Co., Marion, Ind.
Montgomery Bros., San Francisco, Cal.
National Pipe Bending Co., New Haven, Conn.
O'Brien Steam Specialty Co., Syracuse, N. Y.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Quaker City Iron Works, Philadelphia, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sims Co., Erie, Pa.
Standard Heater & Oil Equipment Co., Jersey City, N. J.
Super Radiator Corp., Minneapolis, Minn.
Swartwout Co., Cleveland, O.
Taco Heaters, Inc., New York, N. Y.
●Whitlock Mfg. Co., Hartford, Conn.
Zallea Brothers & Johnson, Wilmington, Del.

HEATERS, WATER, STEAM, STORAGE

Akwa Heaters, Inc., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
●Burnham Boiler Corp., Irvington, N. Y.
Davis Engineering Co., Elizabeth, N. J.
Downingtown Iron Works, Downingtown, Pa.
Frank Heaters, Inc., Paterson, N. J.
General Fittings Co., Providence, R. I.
Gerstein & Cooper Co., South Boston, Mass.
Heat Transfer Products, Inc., New York, N. Y.
Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Corp., Three Rivers, Mich.
●Kewanee Boiler Corp., Kewanee, Ill.
Kopperman & Sons, Joseph, Philadelphia, Pa.
Koven & Bro., Inc., L. O., Jersey City, N. J.
Manitowoc Boiler Wks., Manitowoc, Wis.
Marion Machine Foundry & Supply Co., Marion, Ind.
National Pipe Bending Co., New Haven, Conn.
O'Brien Steam Specialty Co., Syracuse, N. Y.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Quaker City Iron Works, Philadelphia, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Rotary Mfg. Co., Los Angeles, Cal.
Sims Co., Erie, Pa.
Standard Heater & Oil Equipment Co., Jersey City, N. J.
Super Radiator Corp., Minneapolis, Minn.
Vogt Machine Co., Henry, Louisville, Ky.
Warren Electric Appliance Co., Warren, Pa. (Electric)
Waterfilm Boilers, Inc., Jersey City, N. J.
●Whitlock Mfg. Co., Hartford, Conn.

HEATERS, WATER, STEEL, COAL FIRED

Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
●Fitzgibbons Boiler Co., New York, N. Y.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Bros., Inc., Ferrysburg, Mich.
●Kewanee Boiler Corp., Kewanee, Ill.
Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
National Radiator Co., The, Johnstown, Pa.
Pacific Steel Boiler Div., United States Radiator Corp., Detroit, Mich.
Pan-American Engineering Co., Berkeley, Cal.
Spencer Heater Div., The Aviation Corp., Williamsport, Pa.

● Advertisement in this issue. See Index to Advertisers, page 306.

HEATING BOILERS
See Boilers, Heating

HEATING COILS
See Surface, Heating

HEATING SURFACE
See Surface, Heating

HOSE, METAL, FOR ELIMINATING COMPRESSOR VIBRATION
American Metal Hose Branch, American Brass Co., Waterbury, Conn.
Atlantic Metal Hose Co., Inc., New York, N. Y.
●Bendix Aviation Corp., Philadelphia Div., Philadelphia, Pa.
Chicago Metal Hose Corp., Maywood, Ill.
Conklin Brass & Copper Co., Inc., T. E., New York, N. Y.
Everhot Products Co., Chicago, Ill.
Packless Metal Products Corp., New Rochelle, N. Y.
Pennsylvania Flexible Metallic Tubing Co., Philadelphia, Pa.
Seamlex Co., Inc., Long Island City, N. Y.
Titeflex Metal Hose Co., Newark, N. J.
United Metal Hose Co., Inc., Long Island City, N. Y.
Zallea Brothers & Johnson, Wilmington, Del.

HOT WATER HEATING SYSTEMS
See Systems, Heating, Hot Water

HOT WATER PRESSURE REGULATORS
See Regulators, Pressure, Hot Water Heating Systems

HOUSINGS, FAN, CENTRIFUGAL
(Housings only—not complete fans)
Air Controls, Inc., Cleveland, O.
Brundage Co., The, Kalamazoo, Mich.
●Clarage Fan Co., Kalamazoo, Mich.
Commercial Shearing & Stamping Co., Youngstown, O.
●Detroit Stamping Co., Detroit, Mich.
Economy Electric Mfg. Co., Chicago, Ill.
General Blower Corp., San Francisco, Cal.
Hastings Air Conditioning Co., Inc., Hastings, Nebr.
Lau Blower Co., Dayton, O.
National Mfg. & Engineering Co., Detroit, Mich.
Sandberg Sheet Metal Works, Portland, Ore.
Schwitzer-Cummins Co., Indianapolis, Ind.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●**U. S. Air Conditioning Corp., Minneapolis, Minn.**
Viking Air Conditioning Corp., Cleveland, O.

HOUSINGS, FAN, PROPELLER
(Housings only—not complete fans)
Commercial Shearing & Stamping Co., Youngstown, O.
Myers Electric Co., Inc., Pittsburgh, Pa.

HUMIDIFIERS, CENTRAL PLANT
●**Air & Refrigeration Corp., New York, N. Y.**
American Blower Corp., Detroit, Mich.
●**Armstrong Machine Wks., Three Rivers, Mich.**
Bahnson Co., Winston-Salem, N. C.
●**Barber-Colman Co., Rockford, Ill.**
Carrier Corp., Syracuse, N. Y.
●**Clarage Fan Co., Kalamazoo, Mich.**
●**Johnson Service Co., Milwaukee, Wis.**
Mellish & Murray Co., Chicago, Ill.
●**Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.**
Monmouth Products Co., Cleveland, O.
National Engineering & Mfg. Co., Kansas City, Mo.
Parks-Cramer Co., Fitchburg, Mass.
●Powers Regulator Co., Chicago, Ill.
Research Corp., New York, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
Skuttle Mfg. Co., Detroit, Mich.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
Steamaire Co., Cincinnati, O.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Surface Combustion, Toledo, O.
●Trane Co., The, La Crosse, Wis.

HUMIDIFIERS, DIRECT, SPRAY HEAD
●Air & Refrigeration Corp., New York, N. Y.
American Moistening Co., Providence, R. I.
Anetsberger Bros., Chicago, Ill.
Bahnson Co., Winston-Salem, N. C.
Betz Air Conditioning Corp., Kansas City, Mo.
Binks Mfg. Co., Chicago, Ill.
Blower Application Co., Milwaukee, Wis.
●**Buffalo Forge Co., Buffalo, N. Y.**
Chelsea Fan & Blower Co., Irvington, N. J.
International Moistening Co., Providence, R. I.
Lohman Co., Wm. J., Irvington, N. J.
Manufacturers Machine Co., North Andover, Mass.
●**Marley Co., Kansas City, Kans.**
●**Murray Mfg. Co., D. J., Wausau, Wis.**
●New York Blower Co., Chicago, Ill.
Parks-Cramer Co., Fitchburg, Mass.
Pfening Co., Fred D., Columbus, O.
Rhode Island Humidifier & Ventilating Co., Boston, Mass.
Ross Sprinkler Co., Pasadena, Cal.
Somers, Inc., H. J., Detroit, Mich.
Spray Engineering Co., Somerville, Mass.
●**Spraying Systems Co., Chicago, Ill.**
Steamaire Co., Cincinnati, O.
Supreme Electric Products Corp., Rochester, N. Y.
Utility Fan Corp., Los Angeles, Cal.

HUMIDIFIERS FOR RADIATORS AND CONVECTORS
Lowell Air Conditioning Corp., Philadelphia, Pa.
Maid-O'-Mist, Inc., Chicago, Ill.
●**McDonnell & Miller, Chicago, Ill.**
Russell & Co., W. A., Bridgeport, Conn.
Skilbeck Mfg. Co., Kenosha, Wis.

HUMIDIFIERS, RADIATOR VENT VALVE
Maid-O'-Mist, Inc., Chicago, Ill.
Skilbeck Mfg. Co., Kenosha, Wis.

HUMIDIFIERS, UNIT, ROOM TYPE (Without Heating)
Betz Air Conditioning Corp., Kansas City, Mo.
Carrier Corp., Syracuse, N. Y.
Comfort Products Corp., Harvey, Ill.
Coroaire Heater Corp., The, Cleveland, O.
Cugley Incubator Co., Elkhart, Ind.
Fairbanks, Morse & Co., Chicago, Ill.
General Air Conditioning Corp., Cincinnati, O.
Hugo Mfg. Co., Duluth, Minn.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Lion Mfg. Corp., Chicago, Ill.
●Murray Mfg. Co., D. J., Wausau, Wis.
National Engineering & Mfg. Co., Kansas City, Mo.
Norwood Filtration Co., The, Florence, Mass.
Skilbeck Mfg. Co., Kenosha, Wis.
Somers, Inc., H. J., Detroit, Mich.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
Standard Engineering Wks., Pawtucket, R. I.
Steamaire Co., Cincinnati, O.
●**U. S. Air Conditioning Corp., Minneapolis, Minn.**

HUMIDIFYING RADIATORS
See Radiators, Humidifying

HUMIDISTATS
American Moistening Co., Providence, R. I.
Au-Temp-Co Corp., New York, N. Y.
Bahnson Co., Winston-Salem, N. C.
●**Barber-Colman Co., Rockford, Ill.**
Bristol Co., Waterbury, Conn.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
H-B Instrument Co., Philadelphia, Pa.
●**Johnson Service Co., Milwaukee, Wis.**
●**Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.**
Parks-Cramer Co., Fitchburg, Mass.
●Penn Electric Switch Co., Goshen, Ind.
●**Powers Regulator Co., Chicago, Ill.**
Standard Engineering Wks., Pawtucket, R. I.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
●**White-Rodgers Electric Co., St. Louis, Mo.**

HUMIDITY RECORDERS
See Recorders, Humidity

HUMIDITY AND TEMPERATURE CONTROLS
See Humidistats; Recorder-Controllers; Thermostats

HYDRAULIC SPEED CHANGERS
See Changers, Speed, Hydraulic Coupling

HYGROMETERS
American Moistening Co., Providence, R. I.
American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bahnson Co., Winston-Salem, N. C.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Fee and Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.

● Advertisement in this issue. See Index to Advertisers, page 306.

Hill, E. Vernon, Chicago, Ill.
International Moistening Co., Providence, R. I.
●Johnson Service Co., Milwaukee, Wis.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Parks-Cramer Co., Fitchburg, Mass.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Weksler Thermometer Corp., New York, N. Y.

HYGROSTATS

See Humidistats

IMMERSION THERMOSTATS

See Thermostats, Immersion

INDICATING THERMOMETERS

See Thermometers, Indicating

INDICATOR-CONTROLLERS, PRESSURE

Bailey Meter Co., Cleveland, O.
Bristol Co., The, Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Foxboro Co., Foxboro, Mass.
Hanlon-Waters, Inc., Tulsa, Okla.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Wheelco Instruments Co., Chicago, Ill.

INDICATOR-CONTROLLERS, RELATIVE HUMIDITY

●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.

INDICATOR-CONTROLLERS, TEMPERATURE

Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Pyrometer Instrument Co., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
Wheelco Instruments Co., Chicago, Ill.

INDICATORS, CARBON DIOXIDE, BOILER ROOM

For portable CO_2 analyzers, see Analyzers, Carbon Dioxide, Portable

Defender Automatic Regulator Co., St. Louis, Mo.
Engelhard, Inc., Chas., Newark, N. J.
●Hays Corp., Michigan City, Ind.
Leeds & Northrup Co., Philadelphia, Pa.
Permutit Co., New York, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Weaver Mfg. Co., Springfield, Ill.

INDICATORS, SOUND LEVEL

●General Electric Co., Schenectady, N. Y.

INDIRECT HEATING SURFACE

See Surface, Heating

INDIRECT WATER HEATERS

See Heaters, Water, Indirect

INDUSTRIAL AIR CONDITIONERS

See Units, Air Conditioning, Industrial Type

INSTANTANEOUS WATER HEATERS

See Heaters, Water, Steam, Instantaneous

INSULATION, BOILER AND TANK

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Alfol Insulation Co., Inc., New York, N. Y. (Aluminum foil)
●Armstrong Cork Co., Lancaster, Pa.
Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Botfield Refractories Co., Philadelphia, Pa.
●Carey Mfg. Co., Philip, Lockland, Cincinnati, O.
Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Cork)
Eagle-Picher Lead Co., Cincinnati, O.
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Magnesia)
●Grant Wilson, Inc., Chicago, Ill.
Hinde & Dauch Paper Co., Sandusky, O.
International Vermiculite Co., Springfield, Ill.
Jamar Co., Walker, Duluth, Minn.
●Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y. (Asbestos)
Keasbey & Mattison Co., Ambler, Pa.
Krehbiel Co., J. H., Chicago, Ill.
●Mitchell & Smith, Inc., Detroit, Mich.
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
Munn and Steele, Inc., Newark, N. J.
National Gypsum Co., Buffalo, N. Y. (Rock wool)
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos and magnesia)
●Owens-Corning Fiberglas Corp., Toledo, O. (Blanket)
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Poe Co., C. W., Cleveland, O.
Quigley Co., Inc., New York, N. Y.
Refractory & Insulation Corp., New York, N. Y. (Blanket, block, cement)
Reynolds Metals Co., Richmond, Va.
Robinson Insulation Co., Great Falls, Mont.
Ruberoid Co., New York, N. Y. (Asbestos, magnesia)
●Sall Mountain Co., Chicago, Ill.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler Corp., Elizabeth, N. J.
Standard Asbestos Mfg. Co., Chicago, Ill.
Therminsul Corp., Kalamazoo, Mich. (Felted block)
●Union Asbestos & Rubber Co., Cicero, Ill.
United Cork Co., Kearney, N. J. (Cork)
Universal Zonolite Insulation Co., Chicago, Ill. (Plastic)
Walker Jamar Co., Duluth, Minn.
●Wilson, Inc., Grant, Chicago, Ill.

INSULATION, BUILDING

Acme Asbestos Covering & Flooring Co., Chicago, Ill. (Rock wool)
Air-O-Cel Industries, Inc., Detroit, Mich.
Alfol Insulation Co., New York, N. Y. (Aluminum foil)
Alton Mineral Wool Insulation Co., Alton, Ill.
American Flange & Mfg. Co., Inc., New York, N. Y. (Metal sheets)
American Hair & Felt Co., Chicago, Ill. (Hair felt)
●Armstrong Cork Co., Lancaster, Pa. (Corkboard, fibreboard)
Bache & Co., Semon, New York, N. Y. (Glass wool)
Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barber Asphalt Corp., Barber, N. J.
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Cabot, Inc., Samuel, Boston, Mass.(Flexible)
●Carey Mfg Co., Philip, Lockland, Cincinnati, O. (Rock wool)
Carney Rockwool Co., Mankato, Minn.
Celotex Corp., The, Chicago, Ill.
Certain-teed Products Corp., New York, N. Y. (Board, reflective)
Chamberlin Metal Weather Strip Co., Detroit, Mich. (Rock wool)
Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Corkboard)
Doheny Co., John J., Belmont, Mass. (Blanket)
Dry-Zero Corp., Chicago, Ill.
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool, blankets, batts, granulated, loose)
Ehret Magnesia Mfg. Co., Valley Forge, Pa.

Fir-Tex Insulating Board Co., St. Helens, Ore. (Wood fibreboard)
Flintkote Co., The, New York, N. Y. (Fiber board and rock wool)
General Insulating Products Co., Brooklyn, N. Y. (Rock wool)
●Grant Wilson, Inc., Chicago, Ill. (Rockwool)
Hinde & Dauch Paper Co., Sandusky, O.
Insulite Div. Minnesota and Ontario Paper Co., Minneapolis, Minn. (Wood fibre)
Insul-Wool Insulation Corp., Wichita, Kan.
International Vermiculite Co., Springfield, Ill. (Loose fill)
●Johns-Manville, New York, N. Y. (Rock wool and wood fibreboard)
Johnston Tin Foil & Metal Co., St. Louis, Mo. (Foil, aluminum, tin, lead)
Keasbey Co., Robert A., New York, N. Y. (Rock wool)
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Kimberly-Clark Corp., Neenah, Wis.
Marblehead Lime Co., Chicago, Ill. (Rock wool)
Masonite Corp., Cellufoam Products Div., Chicago, Ill.
Mineral Insulation Co., Chicago Ridge, Ill. (Rock wool)
●Mitchell & Smith, Inc., Detroit, Mich.
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
National Gypsum Co., Buffalo, N. Y.
Nelson Mfg. Co., B. F., Minneapolis, Minn.
Northern Steel and Stoker Corp., Peoria, Ill.
●Owens-Corning Fiberglas Corp., Toledo, O.
Pacific Lumber Co., The, San Francisco, Cal.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Plastergon Wall Board Co., Buffalo, N. Y. (Rigid board)
Poe Co., C. W., Cleveland, O.
Refractory & Insulation Corp., New York, N. Y. (Rock, slag wool)
Reynolds Metals Co., Richmond, Va.
Robinson Insulation Co., Great Falls, Mont.
Ruberoid Co., New York, N. Y. (Mineral wool and aluminum foil)
Russell Co., F. C., Cleveland, O.
Silvercote Products, Inc., Chicago, Ill.
Specialty Converters, Inc., East Braintree, Mass. (Reflective insulation)
Sprayo-Flake Co., Chicago, Ill.
Standard Asbestos Mfg. Co., Chicago, Ill. (Asbestos, hairfelt)
Standard Lime & Stone Co., Baltimore, Md. (Rock wool)
Therminsul Corp., Kalamazoo, Mich. (Rock wool block)
Truscon Steel Co., Youngstown, O. (Insulation board sealed between metal sheets)
United Cork Companies, Lyndhurst, N. J. (Cork)
United States Gypsum Co., Chicago, Ill. (Wool and board)
United States Mineral Wool Co., Chicago, Ill. (Mineral wool)
Universal Gypsum & Lime Co., Chicago, Ill. (Loose fill)
Universal Zonolite Insulation Co., Chicago, Ill. (Loose fill)
Upson Co., Lockport, N. Y.
Wilson & Co., Chicago, Ill. (Board)
●Wilson, Inc., Grant, Chicago, Ill. (Rock wool)
Wood Conversion Co., St. Paul, Minn.

INSULATION, CEILING AND WALL, SOUND DEADENING

Acoustical treatment only—for thermal insulation, see Insulation, Building

Air-O-Cel Industries, Inc., Detroit, Mich.
American Hair & Felt Co., Chicago, Ill.
●Armstrong Cork Co., Lancaster, Pa.
Baldwin-Hill Co., Trenton, N. J.
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Berry, Jr. & Co., F. E., Everett, Mass.
Celotex Corp., The, Chicago, Ill.
Doheny Co., John J., Belmont, Mass.
Felters Co., Inc., Boston, Mass.
Fir-Tex Insulating Board Co., St. Helens, Ore.
General Insulating Products Co., Brooklyn, N. Y.
Insulite Div. Minnesota and Ontario Paper Co., Minneapolis, Minn.
Insul-Wool Insulation Corp., Wichita, Kan.
Inter-Coastal Paint Corp., East St. Louis, Ill.
●Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Masonite Corp., Chicago, Ill. (Fibreboard)
●Mitchell & Smith, Inc., Detroit, Mich.
●Mundet Cork Corp., Brooklyn, N. Y.
National Gypsum Co., Buffalo, N. Y.
●Owens-Corning Fiberglas Corp., Toledo, O.
Pacific Lumber Co., The, San Francisco, Cal.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Reynolds Metals Co., Richmond, Va.
Robinson Insulation Co., Great Falls, Mont.
Simplex Ceiling Co., New York, N. Y.
Sprayo-Flake Co., Chicago, Ill.
Therminsul Corp., Kalamazoo, Mich.
Universal Zonolite Insulation Co., Chicago, Ill.
Upson Co., Lockport, N. Y.
Western Silicair Products, Inc., Burbank, Cal.
Wood Conversion Co., St. Paul, Minn.

INSULATION, DUCT, SOUND DEADENING

For application inside duct

American Hair & Felt Co., Chicago, Ill.
Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Berry, Jr. & Co., Inc., F. E., Everett, Mass.
Cabot, Inc., Samuel, Boston, Mass.
●Carey Mfg. Co., Philip, Cincinnati, O.
Celotex Corp., The, Chicago, Ill.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Felters Co., Inc., Boston, Mass.
●Grant Wilson, Inc., Chicago, Ill.
Insulite Div. Minnesota and Ontario Paper Co., Minneapolis, Minn.
●Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Kimberly-Clark Corp., Neenah, Wis.
●Mortell Co., J. W., Kankakee, Ill.
●Owens-Corning Fiberglas Corp., Toledo, O.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Reynolds Metals Co., Richmond, Va.
Robinson Insulation Co., Great Falls, Mont.
Telsit Insulation Co., Bronx, N. Y.
Universal Zonolite Insulation Co., Chicago, Ill.
Western Felt Works, Chicago, Ill.
Western Silicair Products, Inc., Burbank, Cal.
●Wilson, Inc., Grant, Chicago, Ill.

INSULATION, DUCT, THERMAL

Acme Asbestos Covering & Flooring Co., Chicago, Ill. (Asbestos)
Air-O-Cel Industries, Inc., Detroit, Mich.
Alfol Insulation Co., New York, N. Y. (Aluminum, foil)
American Flange & Mfg. Co., Inc., New York, N. Y. (Metal sheets)
American Hair & Felt Co., Chicago, Ill. (Hair felt)
●Armstrong Cork Co., Lancaster, Pa. (Corkboard, fibreboard)
Baldwin-Hill Co., Trenton, N. J.
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Cabot, Inc., Samuel, Boston, Mass. (Flexible)
●Carey Mfg. Co., Philip, Lockland, Cincinnati, O. (Asbestos)
Celotex Corp., The, Chicago, Ill.
Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Cork board)
Dry-Zero Corp., Chicago, Ill.
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool blankets)
Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Cork, magnesia, hair felt)
Felters Co., Inc., Boston, Mass. (Wool felt)
Fir-Tex Insulating Board Co., St. Helens, Ore. (Wood fibreboard)
General Insulating Products Co., Brooklyn, N. Y. (Acoustic rock wool)
Goodrich Co., B. F., Akron, O.
●Grant Wilson, Inc., Chicago, Ill.
Hinde & Dauch Paper Co., Sandusky, O.
Insulite Div. Minnesota and Ontario Paper Co., Minneapolis, Minn. (Wood fibre)
International Vermiculite Co., Springfield, Ill. (Block)
●Johns-Manville, New York, N. Y. (Rock cork, asbestos)
Keasbey Co., Robert A., New York, N. Y. (Asbestos and cork)
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Kennedy, Inc., David E., Brooklyn, N. Y.
Keystone Asphalt Products Co., Chicago, Ill.
Kimberly-Clark Corp., Neenah, Wis.
Masonite Corp., Chicago, Ill.
Mineral Insulation Co., Chicago Ridge, Ill. (Rock wool)
●Mitchell & Smith, Inc., Detroit, Mich. (Cork)
●Mortell Co., J. W., Kankakee, Ill. (Plastic cork coating)
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
Munn and Steele, Inc., Newark, N. J.
National Gypsum Co., Buffalo, N. Y. (Block)
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos and wool felt)
●Owens-Corning Fiberglas Corp., Toledo, O. (Blanket)
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Poe Co., C. W., Cleveland, O.
Quigley Co., Inc., New York, N. Y.
Refractory & Insulation Corp., New York, N. Y. (Block, blanket)
Reynolds Metals Co., Richmond, Va.
Robinson Insulation Co., Great Falls, Mont.
Ruberoid Co., New York, N. Y. (Asbestos cellular and laminated sheets or blocks)
●Sall Mountain Co., Chicago, Ill. (Asbestos)
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler Corp., Elizabeth, N. J. (Asbestos air cell type)
Sprayo-Flake Co., Chicago, Ill.
Standard Asbestos Mfg. Co., Chicago, Ill. (Asbestos, hair felt)
Telsit Insulation Co., Bronx, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 306.

Therminsul Corp., Kalamazoo, Mich. (Rock wool bats, loose and granulated)
United Cork Companies, Lyndhurst, N. J. (Cork)
United States Mineral Wool Co., Chicago, Ill.
Universal Zonolite Insulation Co., Chicago, Ill. (Plastic)
Western Felt Wks., Chicago, Ill. (Felt)
Wilson & Co., Chicago, Ill. (Flexible)
●**Wilson, Inc., Grant, Chicago, Ill.**
Wood Conversion Co., St. Paul, Minn.

INSULATION, PIPE

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Alfol Insulation Co., New York, N. Y. (Aluminum foil)
●**American District Steam Co., North Tonawanda, N. Y. (Underground)**
American Hair & Felt Co., Chicago, Ill.
●Armstrong Cork Co., Lancaster, Pa. (Cork)
Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barrett Div., The, Allied Chemical & Dye Corp., New York, N. Y.
●**Carey Mfg. Co., Philip, Lockland, Cincinnati, O. (Asbestos, magnesia)**
Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., New York, N. Y.
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool)
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Goodrich Co., B. F., Akron, O.
●**Grant Wilson, Inc., Chicago, Ill.**
Hinde & Dauch Paper Co., Sandusky, O.
International Vermiculite Co., Springfield, Ill. (Vermiculite)
Jamar Co., Walker, Duluth, Minn.
●**Johns-Manville, New York, N. Y. (Asbestos, magnesia, rock cork)**
Keasbey Co., Robert A., New York, N. Y. (Asbestos and cork)
Keasbey & Mattison Co., Ambler, Pa. (Asbestos, magnesia)
Masonite Corp., Chicago, Ill.
●Mitchell & Smith, Inc., Detroit, Mich. (Cork)
●Mortell Co., J. W., Kankakee, Ill. (Plastic cork coating)
●**Mundet Cork Corp., Brooklyn, N. Y. (Cork)**
Munn and Steele, Inc., Newark, N. J.
National Gypsum Co., Buffalo, N. Y. (Moulded)
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos, magnesia)
●**Owens-Corning Fiberglas Corp., Toledo, O. (Sectional and flexible)**
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Poe Co., C. W., Cleveland, O.
●**Porter & Co., Inc., H. W., Newark, N. J. (Underground)**
●**Ric-wiL Co., Cleveland, O. (Underground)**
Robinson Insulation Co., Great Falls, Mont.
Ruberoid Co., New York, N. Y. (Asbestos, magnesia)
●Sall Mountain Co., Chicago, Ill. (Asbestos)
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler Corp., Elizabeth, N. J. (Asbestos air cell, wool felt and hair felt)
Standard Asbestos Mfg. Co., Chicago, Ill.
●Union Asbestos & Rubber Co., Cicero, Ill.
United Cork Companies, Lyndhurst, N. J.
Universal Zonolite Insulation Co., Chicago, Ill.
Walker Jamar Co., Duluth, Minn.
●**Wilson, Inc., Grant, Chicago, Ill.**
Wyckoff & Son Co., A., Elmira, N. Y. (Wood)

IONIZATION APPARATUS

Coroaire Heater Corp., The, Cleveland, O.
Electroaire Corp., Chicago, Ill.
Montgomery Bros., San Francisco, Cal.
Norwood Filtration Co., The, Florence, Mass.
Ozo-Ray Process Corp., Chicago, Ill.
United States Ozone Co. of America, Scottdale, Pa.

IRON BODY VALVES

See Valves, Gate; and Valves, Globe

JACKETED PIPE

See Pipe, Jacketed

JOINTS, PIPE, ELECTRICAL INSULATING

Barco Mfg. Co., Chicago, Ill.
Dresser Mfg. Co., Bradford, Pa.

JOINTS, PIPE, EXPANSION, PACKLESS

●**American District Steam Co., North Tonawanda, N. Y.**
Badger Fire Extinguisher Co., Somerville, Mass.
●Badger & Sons Co., E. B., Boston, Mass. (Corrugated copper, stainless steel)
Barco Mfg. Co., Chicago, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Foster Wheeler Corp., New York, N. Y.
●**Fulton Sylphon Co., Knoxville, Tenn.**
Harris & Co., Arthur, Chicago, Ill.
Kopperman & Sons, Joseph, Philadelphia, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Semet-Solvay Engineering Corp., New York, N. Y.
United States Rubber Co., New York, N. Y.
Zallea Brothers & Johnson, Wilmington, Del.

JOINTS, PIPE, EXPANSION, SLIP

●**American District Steam Co., North Tonawanda, N. Y.**
Belfield Co., H., Philadelphia, Pa.
Clow & Sons, James B., Chicago, Ill.
Dresser Mfg. Co., Bradford, Pa.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Howard Iron Works & Alberger Heater Co., Buffalo, N. Y.
●**Illinois Engineering Co., Chicago, Ill.**
Jarecki Mfg. Co., Erie, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Powell Co., Wm., Cincinnati, O.
Semet-Solvay Engineering Corp., New York, N. Y.
Walworth Co., New York, N. Y.
●**Webster & Co., Warren, Camden, N. J.**
●**Yarnall-Waring Co., Philadelphia, Pa.**

JOINTS, PIPE, FLEXIBLE SWING AND REVOLVING

Barco Mfg. Co., Chicago, Ill.
Bordo Co., Inc., L. J., Glenside, Pa.
Flexo Supply Co., Inc., St. Louis, Mo.
Patterson-Ballagh Corp., Los Angeles, Cal.
Powell Co., Wm., Cincinnati, O.
Syntron Co., Homer City, Pa.
Water Cooling Corp., New York, N. Y.

JOINTS, UNIVERSAL, FOR OPERATING VALVES

Blood Brothers Machine Co., Allegan, Mich.
●Brooks Equipment Corp., New York, N. Y.
Consolidated Car-Heating Co., Inc., Albany, N. Y.

KATA THERMOMETERS

See Thermometers, Kata

LACQUERS

See Enamels and Lacquers

LAMPS, STERILIZING, FOR DUCT INSTALLATION

General Electric Co., Lamp Dept., Nela Park, Cleveland, O.
Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

LEAD PIPE

See Pipe and Tubing, Lead and Lead Alloy

LEAD SHEETS

See Sheets, Lead

LEAD TUBING

See Pipe and Tubing, Lead and Lead Alloy

LEAK DETECTORS

See Detectors, Leak, Refrigerant

LEATHER BELTING

See Belting, Flat, Leather

LEATHER PACKING

See Packing, Leather

LIGHTS, PILOT AND SIGNAL

Armstrong Heat Control Co., Portland, Ore.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Dial Light Co. of America, Inc., New York, N. Y.
●General Controls Co., Glendale, Cal.
General Electric Co., Lamp Dept., Nela Park, Cleveland, O.
Hart Mfg. Co., The, Hartford, Conn.
Signal Indicator Co., New York, N. Y.

LIQUID LEVEL GAGES

See Gages, Liquid Level

LIQUID LEVEL RECORDERS

See Recorders, Liquid Level

LIQUID PRESSURE REGULATORS

See Regulators, Pressure, Liquid

LOCK FORMING MACHINES

See Machines, Pittsburgh Lock Forming

LOCK NUTS

See Nuts, Lock

● Advertisement in this issue. See Index to Advertisers, page 306.

LOUVERS AND SHUTTERS, AUTOMATICALLY OR MANUALLY CONTROLLED

Air Conditioning Products Co., Detroit, Mich.
Air Control Products, Inc., Coopersville, Mich.
Air Controls, Inc., Cleveland, O.
Airmaster Corp., Chicago, Ill.
Allen Corp., Detroit, Mich.
American Coolair Corp., Jacksonville, Fla.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
Ames Co., W. R., San Francisco, Cal.
Arex Co., Chicago, Ill.
Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.
•Barber-Colman Co., Rockford, Ill.
Belanger Fan & Blower Co., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., St. Louis, Mo.
Bishop & Babcock Mfg. Co., Cleveland, O.
•Buffalo Forge Co., Buffalo, N. Y.
Burt Mfg. Co., Akron, O.
Campbell Heating Co., E. K., Kansas City, Mo.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., Irvington, N. J.
Chicago Metal Mfg. Co., Chicago, Ill.
Circulators & Devices Mfg. Corp., New York, N. Y.
Clay Equipment Corp., Cedar Falls, Ia.
Dual Air Fan Co., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Elgo Shutter & Mfg. Co., Detroit, Mich.
Gillian Mfg. Co., Detroit, Mich.
Guth Co., Edwin F., St. Louis, Mo.
Hirschman Co., W. F., Buffalo, N. Y.
International Engineering, Inc., Dayton, O.
International Steel Co., Evansville, Ind.
Jamieson Mfg. Co., Dallas, Tex.
Johnson Fan & Blower Corp., Chicago, Ill.
Johnston Co., William W., Dayton, O.
Jordan & Co., Paul R., Indianapolis, Ind.
Kelvin-White Co., Boston, Mass.
King Ventilating Co., Owatonna, Minn.
Kirk & Blum Mfg. Co., Cincinnati, O.
Leslie Welding Co., Chicago, Ill.
Lockjoint Wood Products Co., Wichita, Kans. (Wood; stationary door, wall, window and ceiling)
Lohman Co., Wm. J., Irvington, N. J.
Martin Metal Mfg. Co., Wichita, Kan.
Maysteel Products, Inc., Mayville, Wis.
Meier Electric & Machine Co., Indianapolis, Ind.
Meyer Mfg. Co., Detroit, Mich.
•Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Mountain States Equipment Co., Denver Colo.
Myers Electric Co., Inc., Pittsburgh, Pa.
Peerless Electric Co., Warren, O.
Reed Unit-Fans, Inc., New Orleans, La.
Riggin Metal Products, Inc., Kankakee, Ill.
Robertson Co., H. H., Pittsburgh, Pa.
Schoedinger, F. O., Columbus, O.
Signal Electric Mfg. Co., Menominee, Mich.
•Standard Stamping & Perforating Co., Chicago, Ill.
Supreme Heater & Ventilating Corp., St. Louis, Mo. (Oscillating)
•Tuttle & Bailey, Inc., New Britain, Conn.
United States Register Co., Battle Creek, Mich.
Utility Fan Corp., Los Angeles, Cal.
Van Noorden Co., E., Boston, Mass.
Waterloo Register Co., Waterloo, Ia.

LOW WATER CUT-OFFS

See Cut-Offs, Low Water, Heating Boiler

MACHINES, BLUE PRINT AND WHITE PRINT

For Reproducing Engineering Drawings

Bruning Co., Inc., Charles, Long Island City, N. Y.
Ozalid Products Div., General Aniline & Film Corp., Johnson City, N. Y.
Paragon-Revolute Corp., Rochester, N. Y.
Pease Co., C. F., The, Chicago, Ill.
Peck & Harvey, Chicago, Ill.
Wickes Brothers, Saginaw, Mich.

MACHINES AND FILM, X-RAY

Eastman Kodak Co., Rochester, N. Y.
Kelly-Koet, Covington, Ky.
Westinghouse Electric & Mfg. Co., X-Ray Div., Baltimore, Md.

MACHINES, PIPE CUTTING AND THREADING, PORTABLE

•Air Reduction Sales Co., New York, N. Y. (Cutting and beveling)
Beaver Pipe Tools, Inc., Warren, O.
Curtis & Curtis Co., The, Bridgeport, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
Linde Air Products Co., The, New York, N. Y. (Cutting and beveling)
National Machine Works, Chicago, Ill.
Nye Tool & Machine Wks., The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Ridge Tool Co., Elyria, O. (Hand)
Toledo Pipe Threading Machine Co., Toledo, O.

MACHINES, PIPE CUTTING AND THREADING, STATIONARY

Beaver Pipe Tools, Inc., Warren, O.
Bignall & Keeler Machine Wks., Edwardsville, Ill.
Curtis & Curtis Co., The, Bridgeport, Conn.
Jarecki Mfg. Co., Erie, Pa.
Landis Machine Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders Sons, Inc., D., Yonkers, N. Y.
Spence Engineering Co., Inc., Walden, N. Y. (Beveling and cutting machine)
Toledo Pipe Threading Machine Co., Toledo, O.

MACHINES, PITTSBURGH LOCK FORMING

Binkley Mfg. Co., Warrenton, Mo.
Lockformer Co., Chicago, Ill.
Maplewood Machinery Co., Inc., Chicago, Ill.
Rafter Machine Co., Belleville, N. J.
Whitney Metal Tool Co., Rockford, Ill.

MACHINES, REFRIGERATION, ABSORPTION

Vogt Machine Co., Henry, Louisville, Ky.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
•Worthington Pump & Machinery Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.
York Ice Machinery Corp., York, Pa.

MACHINES, VERTICAL, THREADING AND BORING

•Bullard Co., The, Bridgeport, Conn.

MALLEABLE UNIONS

See Unions, Malleable

MANIFOLDS, REFRIGERATION

Frick Co., Waynesboro, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Kerotest Mfg. Co., Pittsburgh, Pa.
Superior Valve and Fittings Co., Pittsburgh, Pa.
Weatherhead Co., Cleveland, O.
York Ice Machinery Corp., York, Pa.

MANOMETERS

Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
•Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

MECHANICAL DRIVE TURBINES

See Turbines, Mechanical Drive

MECHANICAL SPEED CHANGERS

See Changers, Speed, Mechanical

MECHANICAL TRAPS

See Traps, Steam, Mechanical

MERCURY SWITCHES

See Switches, Mercury

METAL HOSE

See Hose, Metal, for Eliminating Compressor Vibration

● Advertisement in this issue. See Index to Advertisers, page 306.

METALLIC PACKING

See Packing, Metallic

METERS, AIR VELOCITY, DIRECT READING

Detroit Air Meter Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
Taylor Instrument Companies, Rochester, N. Y.

METERS, CONDENSATION

●American District Steam Co., North Tonawanda, N. Y.
Buffalo Meter Co., Buffalo, N. Y.
Central Station Steam Co., Detroit, Mich.
Cochrane Corp., Philadelphia, Pa.
Neptune Meter Co., New York, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Worthington-Gamon Meter Co., Harrison, N. J.

METERS, FLOW, REFRIGERANT

Bristol Co., Waterbury, Conn.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
Neptune Meter Co., New York, N. Y.

METERS, FLOW, STEAM

●American District Steam Co., North Tonawanda, N. Y.
American Meter Co., New York, N. Y.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
Cochrane Corp., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.

METERS, PROCESS LIQUID

American Meter Co., Inc., New York, N. Y.
Bailey Meter Co., Cleveland, O.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Buffalo Meter Co., Buffalo, N. Y.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
Cochrane Corp., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Neptune Meter Co., New York, N. Y.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Republic Flow Meters Co., Chicago, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.
Schutte & Koerting Co., Philadelphia, Pa.
Taylor Instrument Companies, Rochester, N. Y.
Worthington-Gamon Meter Co., Harrison, N. J.

METERS, VOLUME, AIR AND GAS

Bristol Co., The, Waterbury, Conn.
●Hays Corp., Michigan City, Ind.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Roots-Connersville Blower Corp., Connersville, Ind.
Selas Co., The, Philadelphia, Pa.

METERS, WATER

Bailey Meter Co., Cleveland, O.
Buffalo Meter Co., Buffalo, N. Y.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Morey & Jones, Ltd., Los Angeles, Cal.
National Meter Co., Brooklyn, N. Y.
Neptune Meter Co., New York, N. Y.
Pfening Co., Fred D., Columbus, O.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Republic Flow Meters Co., Chicago, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.
Union Water Meter Co., Worcester, Mass.
Worthington-Gamon Meter Co., Harrison, N. J.

MIXING VALVES

See Valves, Mixing, Steam and Water

MODULATING VALVES

See Valves, Radiator, Steam and Hot Water

MOTOR BASES

See Bases and Pads, Vibration Isolating; Bases, Motor, Tension Adjusting

MOTOR CONTROLLERS

See Controllers and Starters, Motor

MOTOR OPERATED VALVES

See Valves, Motor Operated

MOTOR STARTERS

See Controllers and Starters, Motor

MOTORS, ELECTRIC, FRACTIONAL HP

Baldor Electric Co., St. Louis, Mo.
●Barber-Colman Co., Rockford, Ill.
Bodine Electric Co., Chicago, Ill.
Brown-Brockmeyer Co., Dayton, O.
Canatsey Electric Mfg. Co., Kansas City, Mo.
●Century Electric Co., St. Louis, Mo.
Delco Appliance Div., General Motors Corp., Rochester, N. Y.
Delco Products Div., General Motors Corp., Dayton, O.
Diehl Mfg. Co., Elizabethport, N. J.
Emerson Electric Mfg. Co., The, St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
●General Electric Co., Schenectady, N. Y.
Holtzer-Cabot Electric Co., Boston, Mass.
Howell Electric Motors Co., Howell, Mich.
Janette Mfg. Co., Chicago, Ill.
Leland Electric Co., Dayton, O.
Marathon Electric Mfg. Corp., Wausau, Wis.
Master Electric Co., Dayton, O.
Ohio Electric Mfg. Co., Cleveland, O.
Peerless Electric Co., Warren, O.
Reynolds Electric Co., Chicago, Ill.
Robbins & Myers, Inc., Springfield, O.
Russell Electric Co., Chicago, Ill.
Small Motors, Inc., Chicago, Ill.
Speedway Mfg. Co., Chicago (Cicero), Ill.
Sterling Electric Motors, Inc., Los Angeles, Cal.
Sturtevant Co., B. F., Boston, Mass.
U. S. Electrical Motors, Inc., Los Angeles, Cal.
Victor Electric Products, Inc., Cincinnati, O.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS, ELECTRIC, 1 HP AND OVER

Allis Co., Louis, The, Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Baldor Electric Co., St. Louis, Mo.
Bogue Electric Co., Paterson, N. J.
Brown-Brockmeyer Co., Dayton, O.
Burke Electric Co., Erie, Pa.
Byron Jackson Co., Los Angeles, Cal. (Submersible)
Canatsey Electric Mfg. Co., Kansas City, Mo.
●Century Electric Co., St. Louis, Mo.
Continental Electric Co., Inc., Newark, N. J.
Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J.
Delco Products Div., General Motors Corp., Dayton, O.
Diehl Mfg. Co., Elizabethport, N. J.
Electric Machinery Mfg. Co., Minneapolis, Minn.
Emerson Electric Mfg. Co., The, St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
●General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Ideal Electric & Mfg. Co., Mansfield, O.
Imperial Electric Co., Akron, O.
Jackson Co., Byron, Los Angeles, Cal. (Submersible)
Janette Mfg. Co., Chicago, Ill.
Leland Electric Co., Dayton, O.
Marathon Electric Mfg. Corp., Wausau, Wis.
Marble-Card Electric Co., Gladstone, Mich.
Master Electric Co., Dayton, O.
Peerless Electric Co., Warren, O.
Philadelphia Gear Works, Inc., Philadelphia, Pa. (Geared)
Reliance Electric & Engineering Co., Cleveland, O.
Robbins & Myers, Inc., Springfield, O.
Star Electric Motor Co., Bloomfield, N. J.
Sterling Electric Motors, Inc., Los Angeles, Cal.
Sturtevant Co., B. F., Boston, Mass.
U. S. Electrical Motors, Inc., Los Angeles, Cal.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

● Advertisement in this issue. See Index to Advertisers, page 306.

MUSHROOM VENTILATORS
See Ventilators, Mushroom

NEEDLE VALVES
See Valves, Needle

NEUTRALIZERS, ACID
See Dehydrant and Acid Neutralizer

NICKEL AND NICKEL ALLOY PIPE AND FITTINGS
See Tubing, Nickel and Nickel Alloy; Fittings, Pipe, Nickel and Nickel Alloy; Pipe, Nickel and Nickel Alloy

NICKEL AND NICKEL ALLOY SHEETS
See Sheets, Nickel and Nickel Alloy

NIPPLES, PIPE, BRASS AND COPPER
Acheson Mfg. Co., Rankin, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Downs-Smith Brass & Copper Co., New York, N. Y.
●Ellsworth Pipe & Supply Co., Milwaukee, Wis.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Mueller Brass Co., Port Huron, Mich.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Sales & Co., Murray W., Detroit, Mich.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
Weatherhead Co., Cleveland, O.

NIPPLES, PIPE, IRON AND STEEL
Alabama Pipe Co., Anniston, Ala. (Cast iron)
Alloy Steel Products Co., Linden, N. J. (Stainless steel)
●Byers Co., A. M., Pittsburgh, Pa. (Wrought iron)
Chicago Nipple Mfg. Co., Chicago, Ill.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Dresser Mfg. Co., Bradford, Pa. (Swage)
●Ellsworth Pipe & Supply Co., Milwaukee, Wis.
●Flori Pipe Co., The, St. Louis, Mo.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Hasco Valve & Machine Co., Milwaukee, Wis.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Larkin Packer Co., St. Louis, Mo.
Parmelee Mfg. Corp., Utica, N. Y. (Radiator push)
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Sales & Co., Murray W., Detroit, Mich.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

NOISE ELIMINATORS
See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration; Insulation, Sound Deadening

NOZZLES, SPRAY
American Cooling Tower Co., Kansas City, Mo.
American-LaFrance-Foamite Corp., Elmira, N. Y.
April Showers Co., Washington, D. C.
Bahnson Co., Winston-Salem, N. C.
Balloffet Dies and Nozzle Co., Inc., Guttenberg, N. J.
Bayley Blower Co., Milwaukee, Wis.
Benjamin Air Rifle Co., St. Louis, Mo.
Betz Air Conditioning Corp., Kansas City, Mo.
Binks Mfg. Co., Chicago, Ill.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Chain Belt Co., Milwaukee, Wis.
●Clarage Fan Co., Kalamazoo, Mich.
Corning Glass Works, Corning, N. Y. (Glass)
DeVilbiss Co., The, Toledo, O.
Dustlix Corp., Milwaukee, Wis.
Fluor Corp., Ltd., The, Los Angeles, Cal.
International Moistening Co., Providence, R. I.
Link-Belt Co., Chicago, Ill.
Lonn Mfg. Co., Inc., Chicago, Ill.
●Marley Co., Kansas City, Kans.
Martocello & Co., Jos. A., Philadelphia, Pa.
Milburn Co., Alexander, Baltimore, Md.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Parks-Cramer Co., Fitchburg, Mass.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Plummer Spray Equipment Co., Napoleon, O.
Rega Mfg. Co., Rochester, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Ross Sprinkler Co., Pasadena, Cal.
Schubert-Christy Corp., Affton Station, St. Louis, Mo.
Schutte & Koerting Co., Philadelphia, Pa.
Skinner Irrigation Co., Troy, O.
Spray Engineering Co., Somerville, Mass.
●Spraying Systems Co., Chicago, Ill.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Sturtevant Co., B. F., Boston, Mass.
Supreme Electric Products Corp., Rochester, N. Y.
●Trane Co., The, La Crosse, Wis.
Water Cooling Corp., New York, N. Y.
Water Cooling Equipment Corp., St. Louis, Mo.
●Yarnall-Waring Co., Philadelphia, Pa.

NUTS, LOCK
Elastic Stop Nut Corp., Union, N. J.
●Flori Pipe Co., The, St. Louis, Mo.
●Grinnell Co., Inc., Providence, R. I.
Industrial Lock Nut Co., South Hanover, Mass.
Kwikon Co., Chicago, Ill.
Locknut Corp. of America, Chicago, Ill.
MacLean-Fogg Lock Nut Co., Chicago, Ill.
Malleable Iron Fittings Co., Branford, Conn.
Palnut Co., Irvington, N. J.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Standard Pressed Steel Co., Jenkintown, Pa.
Walworth Co., New York, N. Y.

OBSERVATION BOILER PORTS
See Ports, Observation, Boiler

ODOR ADSORBERS
See Filters, Air; Adsorbers, Odor

ODOR NEUTRALIZERS
See Adsorbers, Odor

OIL BURNERS
See Burners, Oil

OIL COOLERS
See Coolers, Oil

OIL FIRED UNIT HEATERS
See Heaters, Unit, Oil Fired

OIL SEPARATORS
See Separators, Steam and Oil

OPEN END WRENCHES
See Wrenches, Open End

OPERATORS, DAMPER, DUCT
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Cook Electric Co., Chicago, Ill.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●Fulton Sylphon Co., Knoxville, Tenn.
●General Controls Co., Glendale, Cal.
●Johnson Service Co., Milwaukee, Wis.
Mason-Nielan Regulator Co., Boston, Mass.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Sampsel Time Control, Inc., Spring Valley, Ill.
Shallcross Controls, Inc., Milwaukee, Wis.
Tagliabue Mfg. Co., C. J., Brooklyn N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Young Regulator Co., Cleveland, O.

OPERATORS, VALVE
Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Cook Electric Co., Chicago, Ill.
Cooper Co., Clark, Palmyra, N. J.
●Crane Co., Chicago, Ill.
Cutler-Hammer, Inc., Milwaukee, Wis.

● Advertisement in this issue. See Index to Advertisers, page 306.

●Fulton Sylphon Co., Knoxville, Tenn.
●General Controls Co., Glendale, Cal.
●Johnson Service Co., Milwaukee, Wis.
Mason-Neilan Regulator Co., Boston, Mass.
●McDonnell & Miller, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
Shallcross Controls, Inc., Milwaukee, Wis.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.

ORIFICES, RADIATOR

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
●Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
New York Air Valve Corp., New York, N. Y.
●Sarco Co., Inc., New York, N. Y.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
Thrush & Co., H. A., Peru, Ind.
●Trane Co., The, La Crosse, Wis.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.

OXY-ACETYLENE WELDING

See Welding and Cutting Apparatus, Oxy-Acetylene

OZONE APPARATUS

Automatic Pump & Softener Corp., Rockford, Ill.
Chelsea Fan & Blower Co., Irvington, N. J.
Coroaire Heater Corp., The, Cleveland, O.
Electroaire Corp., Chicago, Ill.
Lohman Co., Wm. J., Irvington, N. J.
Montgomery Bros., San Francisco, Cal.
Norwood Filtration Co., The, Florence, Mass.
Ozone Air Co., Grand Rapids, Mich.
Ozo-Ray Process Corp., Chicago, Ill.
Russell Electric Co., Chicago, Ill.
Sealkote Corp., Chicago, Ill.
United States Ozone Co. of America, Scottdale, Pa.

PACKING, ASBESTOS

Acme Asbestos Coverings & Flooring Co., Chicago, Ill.
Aeco Packing Products Co., Chicago, Ill.
Allpax Co., Inc., Mamaroneck, N. Y.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., The, Philadelphia, Pa.
●Carey Mfg. Co., Philip, Lockland, Cincinnati, O.
Chicago Specialty Mfg. Co., Chicago, Ill.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Durabla Mfg. Co., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Felt Products Mfg. Co., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Goodyear Tire & Rubber Co., Akron, O.
●Grant Wilson, Inc., Chicago, Ill.
Greene, Tweed & Co., New York, N. Y.
●Jenkins Bros., New York, N. Y.
●Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Klingerit, Inc., New York, N. Y. (Sheet & rod)
Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
Metallo Gasket Co., New Brunswick, N. J.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Quaker Rubber Corp., Philadelphia, Pa.
●Sall Mountain Co., Chicago, Ill.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
●Union Asbestos & Rubber Co., Cicero, Ill.
United States Rubber Co., New York, N. Y.
●Wilson, Inc., Grant, Chicago, Ill.

PACKING, FIBER

Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., The, Philadelphia, Pa.
Darcoid Co., Inc., New York, N. Y.
Durabla Mfg. Co., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Endura Mfg. Corp., Quakertown, Pa.
Garlock Packing Co., Palmyra, N. Y.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
●Jenkins Bros., New York, N. Y.
●Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
McQuay-Norris Mfg. Co., St. Louis, Mo.
Metallo Gasket Co., New Brunswick, N. J.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Quaker Rubber Corp., Philadelphia, Pa.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
●Union Asbestos & Rubber Co., Cicero, Ill.
United States Rubber Co., New York, N. Y.

PACKING, LEATHER

Alexander Bros., Philadelphia, Pa.
Belmont Packing & Rubber Co., The, Philadelphia, Pa.
Chicago Belting Co., Chicago, Ill.
Excelsior Leather Washer Mfg. Co., Rockford, Ill.
Graton & Knight Co., Worcester, Mass.
Houghton & Co., E. F., Philadelphia, Pa.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
●Rhoads & Sons, J. E., Philadelphia, Pa.
Schieren Co., Chas. A., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.
Williams & Son, I. B., Dover, N. H.

PACKING, METALLIC

Aeco Packing Products Co., Chicago, Ill.
Allpax Co., Inc., Mamaroneck, N. Y.
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., The, Philadelphia, Pa.
Conneaut Packing Co., Conneaut, O.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Felt Products Mfg. Co., Chicago, Ill.
France Packing Co., Tacony, Philadelphia, Pa.
Garlock Packing Co., Palmyra, N. Y.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Hound Packing Co., Chicago, Ill.
●Johns-Manville, New York, N. Y.
Klingerit, Inc., New York, N. Y. (Sheet & rod)
Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
McQuay-Norris Mfg. Co., St. Louis, Mo.
National Engineering Products, Inc., Washington, D. C.
National Lead Co., New York, N. Y.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Quaker Rubber Corp., Philadelphia, Pa.
Rotary Seal Co., Chicago, Ill.
●Union Asbestos & Rubber Co., Cicero, Ill.
United States Rubber Co., New York, N. Y.

PACKING, RUBBER AND SYNTHETIC

Aeco Packing Products Co., Chicago, Ill.
Anchor Packing Co., Philadelphia, Pa.
Austin-Mason Co., New York, N. Y.
Belmont Packing & Rubber Co., The, Philadelphia, Pa.
Boston Woven Hose & Rubber Co., Cambridge, Mass.
Chicago Belting Co., Chicago, Ill.
Chicago Specialty Mfg. Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Garlock Packing Co., Palmyra, N. Y.
Gates Rubber Co., Denver, Colo.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Graton & Knight Co., Worcester, Mass.
Hamilton Rubber Mfg. Co., Trenton, N. J.
●Jenkins Bros., New York, N. Y.
●Johns-Manville, New York, N. Y.
Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan Inc., Passaic, N. J.
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
Quaker Rubber Corp., Philadelphia, Pa.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
●Union Asbestos & Rubber Co., Cicero, Ill.
United States Rubber Co., New York, N. Y.

PARTS FOR HEATING AND AIR CONDITIONING EQUIPMENT

Ackermann Mfg. Co., Wheeling, W. Va.
●Carey Mfg. Co., Philip, Cincinnati, O. (Insulating panel for housing and duct construction)
Commercial Shearing & Stamping Co., Youngstown, O. (Tank heads and bottoms, water heater legs, furnace stampings, etc.)
Cross Engineering Co., Carbondale, Pa. (Perforated steel sheets and plates)
●Detroit Stamping Co., Detroit, Mich.

● Advertisement in this issue. See Index to Advertisers, page 306.

Dry-Zero Corp., Chicago, Ill. (Cabinet construction for air conditioning and warm air heating equipment)
Geuder, Paeschke & Frey Co., Milwaukee, Wis.
Technical Ply-Woods, Chicago, Ill. (Plywood panel boards)

PILLOW BLOCK BEARINGS

See Bearings, Pillow Block

PILOT LIGHTS

See Lights, Pilot and Signal

PIPE, ALUMINUM

See Tubing, Aluminum

PIPE, ASBESTOS FIBER AND CEMENT

•Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Ruberoid Co., New York, N. Y.
•Union Asbestos & Rubber Co., Cicero, Ill.
United States Stoneware Co., New York, N. Y.

PIPE BENDERS

See Benders, Pipe

PIPE, BRASS AND COPPER

•American Brass Co., Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Downs-Smith Brass & Copper Co., New York, N. Y.
•Hussey & Co., C. G., Pittsburgh, Pa.
Lewin-Mathes Co., Lewin Metals Div., St. Louis, Mo.
•Mueller Brass Co., Port Huron, Mich.
Revere Copper and Brass, Incorporated, New York, N. Y.
Wolverine Tube Div. of Calumet and Hecla Consolidated Copper Co., Detroit, Mich.

PIPE, CAST IRON, PRESSURE, BELL AND SPIGOT

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Inner-Tite Clamp Corp., Elizabeth, N. J.
Lynchburg Foundry Co., Lynchburg, Va.
McWane Cast Iron Pipe Co., Birmingham, Ala.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE, CAST IRON, PRESSURE, FLANGED

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Inner-Tite Clamp Corp., Elizabeth, N. J.
Lynchburg Foundry Co., Lynchburg, Va.
McWane Cast Iron Pipe Co., Birmingham, Ala.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE, CAST IRON, THREADED

American Cast Iron Pipe Co., Birmingham, Ala.
Clow & Sons, James B., Chicago, Ill.
McWane Cast Iron Pipe Co., Birmingham, Ala.
Somerville Iron Wks., Somerville, N. J.
U. S. Pipe & Foundry Co., Burlington, N. J.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE CLEANING COMPOUNDS

See Compounds, Cleaning, Pipe Coil and Condenser

PIPE COILS

See Coils, Pipe

PIPE COUPLINGS

See Couplings, Pipe

PIPE CUTTERS

See Cutters

PIPE CUTTING MACHINES

See Machines, Pipe Cutting and Threading

PIPE EXTRACTORS

See Extractors, Pipe

PIPE FITTINGS

See Fittings, Pipe

PIPE FLANGES

See Flanges, Pipe

PIPE, GLASS

Corning Glass Wks., Corning, N. Y.

PIPE HANGERS

See Hangers and Supports, Pipe

PIPE, HARD RUBBER

American Hard Rubber Co., New York, N. Y.
Goodrich Co., B. F., Akron, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Manhattan Rubber Mfg. Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Stokes Rubber Co., Jos., Trenton, N. J.
United States Rubber Co., New York, N. Y.

PIPE INSULATION

See Insulation, Pipe

PIPE, JACKETED

Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Parks-Cramer Co., Fitchburg, Mass.

PIPE JOINT COMPOUNDS

See Cement and Compounds, Pipe Joint

PIPE, LINED

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
•American Brass Co., Waterbury, Conn. (Tin)
American Cast Iron Pipe Co., Birmingham, Ala. (Cement)
American Hard Rubber Co., New York, N. Y. (Rubber)
Clow & Sons, James B., Chicago, Ill.
Cohoes Rolling Mill Co., Cohoes, N. Y. (Cement)
General Plate Div., Metals & Controls Corp., Attleboro, Mass. (Silver lined)
Goodrich Co., B. F., Akron, O. (Rubber-lined)
Jones & Laughlin Steel Corp., Pittsburgh, Pa. (Cement)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead and tin lined)
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Manhattan Rubber Mfg. Co. Div. of Raybestos-Manhattan, Inc., Passaic, N. J. (Rubber)
National Lead Co., New York, N. Y. (Lead)
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa. (Cement)
Public Works Supply Co., Lynn, Mass. (Cement)
Resisto Pipe & Valve Co., East Cambridge, Mass. (Lead)
United States Rubber Co., New York, N. Y. (Rubber)
Vesco Corp., New York, N. Y. (Enamel)
Warren Foundry & Pipe Corp., New York, N. Y. (Cement-bituminous enamel)
•Youngstown Sheet & Tube Co., Youngstown, O.

PIPE LINE STRAINERS

See Strainers, Pipe Line

PIPE, NICKEL AND NICKEL ALLOY

General Plate Div., Metals & Controls Corp., Attleboro, Mass.
•International Nickel Co., New York, N. Y.
Revere Copper and Brass Incorporated, New York, N. Y.

PIPE NIPPLES

See Nipples, Pipe

PIPE, PLASTIC

Acadia Synthetic Products Div., Western Felt Works, Chicago, Ill.
American Hard Rubber Co., New York, N. Y.
Continental Diamond Fibre Co., Newark, Del.
Dow Chemical Co., Midland, Mich.
Extruded Plastics, Inc., Norwalk, Conn.
Mills Corp., Elmer E., Chicago, Ill.
North Penn Co., New York, N. Y.

PIPE, PRE-INSULATED

Ehret Magnesia Mfg. Co., Valley Forge, Pa.
•Ric-wiL Co., Cleveland, O.

PIPE REAMERS

See Reamers, Pipe

• Advertisement in this issue. See Index to Advertisers, page 306.

PIPE REPAIR CLAMPS
See Clamps, Pipe Repair

PIPE, SPIRAL, RIVETED AND WELDED
●American Rolling Mill Co., The, Middletown, O.
Naylor Pipe Co., Chicago, Ill.
Revere Copper and Brass Incorporated, New York, N. Y.
●Taylor Forge & Pipe Wks., Chicago, Ill.

PIPE, STEEL, BUTT AND LAP WELDED
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
●American Rolling Mill Co., The, Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Biggs Boiler Works Co., E. Akron, O.
●Byers Co., A. M., Pittsburgh, Pa.
Chicago Bridge & Iron Co., Chicago, Ill. (Specially fabricated)
Cohoes Rolling Mill Co., Cohoes, N. Y.
Fretz-Moon Tube Co., Butler, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Oil City Tank and Boiler Co., Oil City, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Pittsburgh Tube Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.
Revere Copper and Brass Incorporated, New York, N. Y.
Semet-Solvay Engineering Corp., New York, N. Y. (Specially fabricated)
South Chester Tube Co., Chester, Pa.
●Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.
Tippett & Wood, Phillipsburg, N. J. (12 in. and larger)
Wheatland Tube Co., Philadelphia, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
●Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, STEEL, SEAMLESS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
●Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.
●Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, STEEL, STAINLESS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Alloy Steel Products Co., Linden, N. J.
●American Rolling Mill Co., The, Middletown, O.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Colonial Alloys Co., Metals Div., Philadelphia, Pa.
Globe Steel Tubes Co., Milwaukee, Wis.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Cleveland, O.

PIPE, STONEWARE
General Ceramics Co., Keasbey, N. J.
Knight, Maurice A., Akron, O. (Stoneware)
United States Stoneware Co., New York, N. Y. (Stoneware)

PIPE SUPPORTS
See Hangers and Supports, Pipe

PIPE TONGS
See Tongs, Pipe

PIPE, TUBING, FITTINGS AND VALVES, CARBON AND GRAPHITE
National Carbon Co., Carbon Sales Div., Cleveland, O.

PIPE AND TUBING, LEAD AND LEAD ALLOY
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
●American Smelting & Refining Co., New York, N. Y.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.
Rochester Lead Works, Inc., Rochester, N. Y.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

PIPE VISES
See Vises, Pipe

PIPE, WOOD
●American District Steam Co., North Tonawanda, N. Y.
Caldwell Co., W. E., Louisville, Ky.
Michigan Pipe Co., Bay City, Mich.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE WRENCHES
See Wrenches, Pipe

PIPE, WROUGHT IRON
●Byers Co., A. M., Pittsburgh, Pa.
South Chester Tube Co., Chester, Pa.

PISTON RINGS
See Rings, Piston

PITOT TUBES
See Tubes, Pitot

PITTSBURGH LOCK FORMING MACHINES
See Machines, Pittsburgh Lock Forming

PLASTIC PIPE AND PIPE FITTINGS
See Pipe, Plastic; Fittings, Pipe, Plastic

PLASTIC TUBING
See Tubing, Plastic

PLATES, FLOOR AND CEILING
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Nipple Mfg. Co., Chicago, Ill.
Farley Sleeve & Hanger Co., Cleveland, O.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
●Flori Pipe Co., The, St. Louis, Mo.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Jarecki Mfg. Co., Erie, Pa.
Keeney Mfg. Co., Newington, Conn.
●Little Mfg. Co., M. S., Hartford, Conn.
Newman Brothers, Inc., Cincinnati, O.
Ravena Iron Co., Ravena, N. Y.
Russell Mfg. Co., John M., Naugatuck, Conn.
Walworth Co., New York, N. Y.

PLUG COCKS
See Valves, Plug

PLUG VALVES
See Valves, Plug

PORTS, OBSERVATION, BOILER
Detroit Stoker Co., Detroit, Mich.
Preferred Utilities Mfg. Corp., New York, N. Y.

POWER SHEARS
See Shears, Power

PREHEATERS, FUEL OIL
●American District Steam Co., North Tonawanda, N. Y.
American Locomotive Co., Alco Products Div., New York, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
Davis Engineering Corp., Elizabeth, N. J.
Downingtown Iron Works, Downingtown, Pa.
Engineer Co., New York, N. Y.
Frank Heaters, Inc., Paterson, N. J.
General Fittings Co., Providence, R. I.
Griscom-Russell Co., New York, N. Y.
Heat Transfer Products, Inc., New York, N. Y.
Hynes Electric Heating Co., Camden, N. J.
Johnson Corp., Three Rivers, Mich.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
National Airoil Burner Co., Inc., Philadelphia, Pa.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Preferred Utilities Mfg. Corp., New York, N. Y.
Richmond Engineering Co., Inc., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Semet-Solvay Engineering Corp., New York, N. Y.
Sims Co., Erie, Pa.

● Advertisement in this issue. See Index to Advertisers, page 306.

Standard Heater & Oil Equipment Co., Jersey City, N. J.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Struthers Wells Corp., Titusville, Pa.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Danvers, Mass.
Warren Electric Appliance Co., Warren, Pa.
●Whitlock Mfg. Co., Hartford, Conn.
●Wiegand Co., Edwin L., Pittsburgh, Pa.
Zallea Brothers & Johnson, Wilmington, Del.

PREHEATERS AND STRESS RELIEVERS, ELECTRIC, FOR PIPE WELDS

Electric Arc, Inc., Newark, N. J.
Kuhlman Electric Co., Detroit Electric Furnace Div., Bay City, Mich.
Swoboda, Inc., H. O., New Brighton, Pa.
Trent Co., Harold E., Philadelphia, Pa.

PRE-INSULATED PIPE

See Pipe, Pre-Insulated

PRESSURE BLOWERS

See Blowers, High Pressure

PRESSURE CONTROLLERS

See Regulators, Pressure

PRESSURE GAGES

See Gages, Indicating, Pressure

PRESSURE INDICATOR-CONTROLLERS

See Indicator-Controllers, Pressure

PRESSURE RECORDER-CONTROLLERS

See Recorder-Controllers, Pressure

PRESSURE RECORDERS

See Recorders, Pressure and Vacuum

PRESSURE REDUCING VALVES

See Valves, Pressure Reducing and Regulating

PRESSURE REGULATING VALVES

See Valves, Pressure Reducing and Regulating

PRESSURE REGULATORS

See Regulators, Pressure

PRESSURE SWITCHES

See Switches, Pressure and Vacuum

PROCESS HEATING SYSTEMS

See Systems, Process Heating, High Temperature

PROCESS STEAM SUPERHEATERS

See Superheaters, Process Steam

PROCESS AND STORAGE TANKS

See Tanks, Process and Storage

PROPELLER FANS

See Fans, Propeller

PROPORTIONING PUMPS

See Pumps, Proportioning

PROTECTIVE COATINGS

See Coatings, Protective, for Metal

PROTECTORS, PIPE COVERING

●American District Steam Co., North Tonawanda, N. Y.
Carpenter & Paterson, Inc., East Boston, Mass.
Cheney Metal Products Co., Trenton, N. J.
●Grinnell Co., Inc., Providence, R. I.
●Ric-wiL Co., Cleveland, O.

PSYCHROMETERS, SLING AND HAND ASPIRATED

American Moistening Co., Providence, R. I.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Parks-Cramer Co., Fitchburg, Mass.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Weksler Thermometer Corp., New York, N. Y.

PSYCHROSTATS

See Humidistats

PULLEYS AND SHEAVES, FOR BELT DRIVES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Congress Die Casting Div., Congress Tool & Die Co., Detroit, Mich.
Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J. (Steel split)
Gates Rubber Co., The, Denver, Colo.
Goldens' Foundry & Machine Co., Columbus, Ga.
Morrison Products, Inc., Cleveland, O.
Rockwood Mfg. Co., Indianapolis, Ind.
Smith, Inc., Winfield H., Springville, N. Y.
Speedmaster Co., The, Des Plaines, Ill.
Swift Mfg. Co., Detroit, Mich. (Cast iron)
Thermoid Rubber, Div. of Thermoid Co., Trenton, N. J.
Utility Fan Corp., Los Angeles, Cal.
Wood's Sons Co., T. B., Chambersburg, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMP BASES

See Bases and Pads, Vibration Isolating

PUMPS, BOILER FEED

Acker Organization, Inc., W. M., Cleveland, O.
Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Berns Specialty Mfg. Co., Chicago, Ill.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Byron Jackson Co., Los Angeles, Cal.
Chicago Pump Co., Chicago, Ill.
Cissell Mfg. Co., W. M., Louisville, Ky.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
●Dean Brothers Pumps, Inc., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
●Economy Pumps, Inc., Hamilton, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
●Frederick Iron & Steel Co., Frederick, Md.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Jackson Co., Byron, Los Angeles, Cal.
Johnson Corp., Three Rivers, Mich.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Morehead Mfg. Co., Detroit, Mich.
Morris Machine Works, Baldwinsville, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
National Steam Pump Co., Upper Sandusky, O.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Pacific Pump Works, Huntington Park, Cal.
Robbins & Myers, Inc., Springfield, O.
Schaub Engineering Co., Fred H., Chicago, Ill.
Sellers Engineering Co., Chicago, Ill.
Skidmore Corp., St. Joseph, Mich.
Sterling, Inc., Milwaukee, Wis.
Swaby Mfg. Co., Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 306.

Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
Westco Div., Pomona Pump Co., St. Louis, Mo.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL

Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Ames Hydrovac Corp., Brooklyn, N. Y.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Barrett, Haentjens & Co., Hazleton, Pa.
Beach-Russ Co., New York, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
Berns Specialty Mfg. Co., Chicago, Ill.
Blaisdell Compressor Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Byron Jackson Co., Los Angeles, Cal.
Chain Belt Co., Milwaukee, Wis.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
●Dean Brothers Pumps, Inc., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
●Dunham Co., C. A., Chicago, Ill.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Eastern Engineering Co., New Haven, Conn.
●Economy Pumps, Inc., Hamilton, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
●Frederick Iron & Steel Co., Frederick, Md.
Fulflo Specialties Co., Inc., The, Blanchester, O.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Jackson Co., Byron, Los Angeles, Cal.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kraissl Co., Inc., The, Hackensack, N. J.
La Bour Co., Inc., The, Elkhart, Ind.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Morris Machine Wks., Baldwinsville, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Pacific Pump Works, Huntington Park, Cal.
Palmer Electric Co., Detroit, Mich.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Quimby Pump Co., Inc., Newark, N. J.
Red Jacket Mfg. Co., Davenport, Ia.
Schneible Co., Claude B., Chicago, Ill.
Schwitzer-Cummins Co., Indianapolis, Ind.
Skidmore Corp., St. Joseph, Mich.
Swaby Mfg. Co., Chicago, Ill.
Taber Pump Co., Buffalo, N. Y.
●Trane Co., The, La Crosse, Wis.
Union Steam Pump Co., Battle Creek, Mich.
Utility Fan Corp., Los Angeles, Cal.
Warren Steam Pump Co., Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
Weinman Pump Mfg. Co., Columbus, O.
Westco Div., Pomona Pump Co., St. Louis, Mo.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CONDENSATION RETURN

Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Ames Hydrovac Corp., Brooklyn, N. Y.
Aurora Pump Co., Aurora, Ill.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Byron Jackson Co., Los Angeles, Cal.
Chicago Pump Co., Chicago, Ill.
Cissell Mfg. Co., W. M., Louisville, Ky.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
●Dean Brothers Pumps, Inc., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
●Dunham Co., C. A., Chicago, Ill.
Eastern Engineering Co., New Haven, Conn.
Eclipse Fuel Engineering Co., Rockford, Ill.
●Economy Pumps, Inc., Hamilton, O.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
●Frederick Iron & Steel Co., Frederick, Md.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Heating Assurance, Inc., Spokane, Wash.
●Hoffman Specialty Co., Indianapolis, Ind.
Ingersoll-Rand, New York, N. Y.
Jackson Co., Byron, Los Angeles, Cal.
Johnson Corp., Three Rivers, Mich.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Morehead Mfg. Co., Detroit, Mich.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
National Steam Pump Co., Upper Sandusky, O.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
O'Brien Steam Specialty Co., Syracuse, N. Y.
Pacific Pump Works, Huntington Park, Cal.
Quimby Pump Co., Inc., Newark, N. J.
Schaub Engineering Co., Fred H., Chicago, Ill.
Sellers Engineering Co., Chicago, Ill.
Skidmore Corp., St. Joseph, Mo.
Sterling, Inc., Milwaukee, Wis.
Swaby Mfg. Co., Chicago, Ill.
●Trane Co., The, La Crosse, Wis.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
Weinman Pump Co., Columbus, O.
Westco Div., Pomona Pump Co., St. Louis, Mo.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, DEEP WELL, TURBINE

American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Aurora Pump Co., Aurora, Ill.
Byron Jackson Co., Los Angeles, Cal.
Cook, Inc., A. D., Lawrenceburg, Ind.
Davidson Co., M. T., New York, N. Y.
Deming Co., Salem, O.
Duro Co., Dayton, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Jackson Co., Byron, Los Angeles, Cal.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
Layne & Bowler, Inc., Memphis, Tenn.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Pacific Pump Works, Huntington Park, Cal.
Peerless Pump Div., Food Machinery Corp., Canton, O.
Pomona Pump Co., Pomona, Cal.
Red Jacket Mfg. Co., Davenport, Ia.
Uniflow Mfg. Co., Erie, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, FIRE

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Blackmer Pump Co., Grand Rapids, Mich.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Byron Jackson Co., Los Angeles, Cal.
Chicago Pump Co., Chicago, Ill.
Dayton-Dowd Co., Quincy, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
●Economy Pumps, Inc., Hamilton, O.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Jackson Co., Byron, Los Angeles, Cal.
Lecourtenay Co., Newark, N. J.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Morris Machine Wks., Baldwinsville, N. Y.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Pomona Pump Co., Pomona, Cal.
Viking Pump Co., Cedar Falls, Ia.
Warren Steam Pump Co., Inc., Warren, Mass.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, LIQUID REFRIGERANT CIRCULATING

Byron Jackson Co., Los Angeles, Cal.
●Economy Pumps, Inc., Hamilton, O.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 306.

Jackson Co., Byron, Los Angeles, Cal.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Red Jacket Mfg. Co., Davenport, Ia.
Warren Steam Pump Co., Inc., Warren, Mass.
Westco Div., Pomona Pump Co., St. Louis, Mo.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, PROPORTIONING

Cochrane Corp., Philadelphia, Pa.
Dearborn Chemical Co., Chicago, Ill.
Duro Co., Dayton, O.
Eastern Engineering Co., New Haven, Conn.
Haering Co., Inc., D. W., Chicago, Ill.
Jabsco Pump Co., Beverly Hills, Cal.
Nelson Chemical Pumps, Casper, Wyo.
% Proportioneers, Inc. %, Providence, R. I.
Roy Pumps, Milton, Philadelphia, Pa.
Wallace & Tiernan Co., Inc., Belleville, N. J.

PUMPS, RECIPROCATING

Aldrich Pump Co., Allentown, Pa.
Alten's Foundry & Machine Works, Lancaster, O.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Columbus Steam Pump Wks., Columbus, O.
Davidson Co., M. T., New York, N. Y.
●Dean Brothers Pumps, Inc., Indianapolis, Ind.
Delco Appliance Div., General Motors Corp., Rochester, N. Y.
Deming Co., Salem, O.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pumps Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Ingersoll-Rand, New York, N. Y.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Myers & Bro. Co., F. E., The, Ashland, O.
National Steam Pump Co., Upper Sandusky, O.
Red Jacket Mfg. Co., Davenport, Ia.
Roy Pumps, Milton, Philadelphia, Pa.
Uniflow Mfg. Co., Erie, Pa.
Union Steam Pump Co., Battle Creek, Mich
Warren Steam Pump Co., Inc., Warren, Mass.
●Watson-Stillman Co., Roselle, N. J.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, ROTARY

Allen Billmyre Corp., Mamaroneck, N. Y.
American Hard Rubber Co., New York, N. Y. (Hard Rubber)
Beach-Russ Co., New York, N. Y.
Blackmer Pump Co., Grand Rapids, Mich.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Eastern Engineering Co., New Haven, Conn.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Lammert & Mann Co., Chicago, Ill.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Martocello & Co., Jos. A., Philadelphia, Pa.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Peerless Pump Div., Food Machinery Corp., Canton, O.
Quimby Pump Co., Inc., Newark, N. J.
Red Jacket Mfg. Co., Davenport, Ia.
Robbins & Myers, Inc., Springfield, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Roper Corp., Geo. D., Rockford, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Scott-Newcomb, Inc., St. Louis, Mo.
Sundstrand Machine Tool Co., Rockford, Ill.
Taber Pump Co., Buffalo, N. Y.
Trimount Rotary Power Co., East Dedham, Mass.
Tuthill Pump Co., Chicago, Ill.
Viking Pump Co., Cedar Falls, Ia.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, STEAM

American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
●Dean Brothers Pumps, Inc., Indianapolis, Ind.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
National Steam Pump Co., Upper Sandusky, O.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
●Watson-Stillman Co., Roselle, N. J.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, SUMP

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Byron Jackson Co., Los Angeles, Cal.
Chicago Pneumatic Tool Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
Dean Hill Pump Co., Anderson, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
Duro Co., Dayton, O.
Eastern Engineering Co., New Haven, Conn.
●Economy Pumps, Inc., Hamilton, O.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
●Frederick Iron & Steel Co., Frederick, Md.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand, New York, N. Y.
Jabsco Pump Co., Beverly Hills, Cal.
Jackson Co., Byron, Los Angeles, Cal.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Lawrence Pump & Engine Co., Lawrence, Mass.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Morris Machine Wks., Baldwinsville, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
Noera Mfg. Co., Div. Chase Brass & Copper Co., Waterbury, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Penberthy Injector Co., Detroit, Mich.
Pomona Pump Co., Pomona, Cal.
Quimby Pump Co., Inc., Newark, N. J.
Red Jacket Mfg. Co., Davenport, Ia.
Schneible Co., Claude B., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Swaby Mfg. Co., Chicago, Ill.
Taber Pump Co., Buffalo, N. Y.
Triplex Heating Specialty Co., Peru, Ind.
Uniflow Mfg. Co., Erie, Pa.
Union Steam Pump Co., Battle Creek, Mich
Weil Pump Co., Chicago, Ill.
Weinman Pump Co., Columbus, O.
●Worthington Pump & Machinery Corp., Harrison, N. J
Yeomans Bros Co., Chicago, Ill.

PUMPS, VACUUM

Allen Billmyre Corp., Mamaroneck, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Beach-Russ Co., New York, N. Y.
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Davidson Co., M. T., New York, N. Y.
●Dean Brothers Pumps, Inc., Indianapolis, Ind.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Domestic Engine & Pump Co., Shippensburg, Pa.
●Dunham Co., C. A., Chicago, Ill.
●Economy Pumps, Inc., Hamilton, O.
Eisler Engineering Corp., Newark, N. J.
Elliott Co., Jeanette, Pa.
Foster Pump Works, Inc., Brooklyn, N. Y.
Foster Wheeler Corp., New York, N. Y.
Fuller Co., Catasauqua, Pa.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
●Hoffman Specialty Co., Indianapolis, Ind.
Ingersoll-Rand, New York, N. Y.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Lammert & Mann Co., Chicago, Ill.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
●Nash Engineering Co., South Norwalk, Conn.
National Steam Pump Co., Upper Sandusky, O.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Roots-Connersville Blower Corp., Connersville, Ind.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 306.

Schutte & Koerting Co., Philadelphia, Pa.
Skidmore Corp., St. Joseph, Mich.
Sterling, Inc., Milwaukee, Wis.
Trimount Rotary Power Co., East Dedham, Mass.
Union Steam Pump Co., Battle Creek, Mich.
Viking Pump Co., Cedar Falls, Ia.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, VACUUM HEATING

American-Marsh Pumps, Inc., Battle Creek, Mich.
Ames Hydrovac Corp., Brooklyn, N. Y.
Beach-Russ Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Works Co., Columbus, O.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Domestic Engine & Pump Co., Shippensburg, Pa.
●Dunham Co., C. A., Chicago, Ill.
●Economy Pumps, Inc., Hamilton, O.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
Gylstrom Co., O., Milwaukee, Wis.
●Hoffman Specialty Co., Indianapolis, Ind.
Ingersoll-Rand, New York, N. Y.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
●Nash Engineering Co., South Norwalk, Conn.
Roots-Connersville Blower Corp., Connersville, Ind.
Skidmore Corp., St. Joseph, Mich.
Sterling, Inc., Milwaukee, Wis.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Whittington Pump & Engineering Co., Indianapolis, Ind.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, VISCOUS LIQUIDS AND HEAVY MATERIALS

Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
Beach-Russ Co., New York, N. Y.
Blackmer Pump Co., Grand Rapids, Mich.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Byron Jackson Co., Los Angeles, Cal.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
●Dean Brothers Pumps, Inc., Indianapolis, Ind.
●Economy Pumps, Inc., Hamilton, O.
Engineer Co., New York, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
●Frederick Iron & Steel Co., Frederick, Md.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Jabsco Pump Co., Beverly Hills, Cal.
Jackson Co., Byron, Los Angeles, Cal.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Lawrence Pump & Engine Co., Lawrence, Mass.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Morris Machine Wks., Baldwinsville, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Red Jacket Mfg. Co., Davenport, Ia.
Robbins & Myers, Inc., Springfield, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Roper Corp., Geo. D., Rockford, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Taber Pump Co., Buffalo, N. Y.
Tuthill Pump Co., Chicago, Ill.
Union Steam Pump Co., Battle Creek, Mich.
Viking Pump Co., Cedar Falls, Ia.
Warren Steam Pump Co., Inc., Warren, Mass.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUNCHES, SHEET METAL

Beatty Machine & Mfg. Co., Hammond, Ind.
Bertsch & Co., Inc., Cambridge City, Ind.
Bliss Co., E. W., Toledo, O.
●Buffalo Forge Co., Buffalo, N. Y.
Callahan Can Machine Co., Inc., Brooklyn, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Greenlee Tool Co., Rockford, Ill.
Heartley Machine & Tool Co., Toledo, O.
Hendley & Whittemore Co., Beloit, Wis.
Henry & Wright Mfg. Co., Hartford, Conn.
International Nutyp Tool Co., Oswego, N. Y.
Kidder Mfg. Co., Inc., J. F., Burlington, Vt.
New Albany Machine Mfg. Co., New Albany, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Parker-Kalon Corp., New York, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Perkins Machine Co., Warren, Mass.
Rock River Machine Co., Inc., Janesville, Wis.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
Service Machine Co., Elizabeth, N. J.
Swaine Mfg. Co., Fred J., St. Louis, Mo.
Verson Allsteel Press Co., Chicago, Ill.
Whitney Mfg. Co., W. A., Rockford, Ill.
Whitney Metal Tool Co., Rockford, Ill.
Wiedemann Machine Co., Philadelphia, Pa.
Zeh & Hahnemann Co., Newark, N. J.

PURGERS, REFRIGERANT GAS

●Armstrong Machine Works, Three Rivers, Mich.
Frick Co., Waynesboro, Pa.

RADIATION, CONVECTION TYPE, FERROUS

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Burnham Boiler Corp., Irvington, N. Y.
●Crane Co., Chicago, Ill.
●Dunham Co., C. A., Chicago, Ill.
National Radiator Co., The, Johnstown, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
●Shaw-Perkins Mfg. Co., Pittsburgh, Pa.
●Smith Co., Inc., The, H. B., Westfield, Mass.
●Trane Co., The, La Crosse, Wis.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Vulcan Radiator Co., Hartford, Conn.
Weil-McLain Co., Chicago, Ill.
●Young Radiator Co., Racine, Wis.

RADIATION, CONVECTION TYPE, NON-FERROUS

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Beacon-Morris Corp., Boston, Mass.
●Bush Mfg. Co., Hartford, Conn.
●Dunham Co., C. A., Chicago, Ill.
●G. & O. Mfg. Co., New Haven, Conn.
●Grinnell Co., Inc., Providence, R. I.
Kehm Corp., The, Chicago, Ill.
●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
Refrigeration Economics Co., Inc., Canton, O.
Rome-Turney Radiator Co., Rome, N. Y.
●Shaw-Perkins Mfg. Co., Pittsburgh, Pa.
Super Radiator Corp., Minneapolis, Minn.
Tilco-Fin, Inc., Brooklyn, N. Y.
●Trane Co., The, La Crosse, Wis.
●Tuttle & Bailey, Inc., New Britain, Conn.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vulcan Radiator Co., Hartford, Conn.
●Young Radiator Co., Racine, Wis.

RADIATION, DIRECT

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Burnham Boiler Corp., Irvington, N. Y.
Clow & Sons, James B., Chicago, Ill. (Gas fired)
Columbia Radiator Co., McKeesport, Pa.
●Crane Co., Chicago, Ill.
Fowler & Wolfe Radiator Co., Norristown, Pa.
International Heater Co., Utica, N. Y.
Kohler Co., Kohler, Wis.
National Radiator Co., The, Johnstown, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Slater Mfg. Co., Wakefield, Mass. (Baseboard)
●Smith Co., Inc., H. B., The, Westfield, Mass.
Thatcher Furnace Co., Garwood, N. J.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.

RADIATOR AND CONVECTOR HUMIDIFIERS

See Humidifiers for Radiators and Convectors

RADIATOR HANGERS

See Hangers or Brackets, Radiator

RADIATOR ORIFICE VALVES

See Valves, Radiator, Orifice

RADIATOR ORIFICES

See Orifices, Radiator

● Advertisement in this issue. See Index to Advertisers, page 306.

RADIATOR VALVES

See Valves, Radiator

RADIATORS, GAS FIRED

Automatic Gas Equipment Co., Pittsburgh, Pa.
Pacific Airmax Corp., Huntington Park, Cal.

RADIATORS, HUMIDIFYING

●Burnham Boiler Corp., Irvington, N. Y.
Utica Radiator Corp., Utica, N. Y.

RADIATOR VENT VALVE HUMIDIFIERS

See Humidifiers, Radiator Vent Valve

RATCHET WRENCHES

See Wrenches, Ratchet

REAMERS, PIPE

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Crown Die & Tool Co., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Mueller Co., Decatur, Ill.
Nye Tool & Machine Wks., The, Chicago, Ill.
Toledo Pipe Threading Machine Co., Toledo, O.

RECIPROCATING PUMPS

See Pumps, Reciprocating

RECORDER-CONTROLLERS, COMBINED TEMPERATURE AND HUMIDITY

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
●Powers Regulator Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDER-CONTROLLERS, HUMIDITY

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
●Powers Regulator Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDER-CONTROLLERS, PRESSURE

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Foxboro Co., Foxboro, Mass.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Wheelco Instrument Co., Chicago, Ill.

RECORDER-CONTROLLERS, TEMPERATURE

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●Powers Regulator Co., Chicago, Ill.
Pyrometer Instrument Co., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
Wheelco Instruments Co., Chicago, Ill.

RECORDERS, CARBON DIOXIDE

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Defender Automatic Regulator Co., St. Louis, Mo.
Engelhard, Inc., Charles, Newark, N. J.
Foxboro Co., Foxboro, Mass.
●Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Permutit Co., New York, N. Y.
Precision Control Co., San Francisco, Cal.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Uehling Instrument Co., Paterson, N. J.

RECORDERS, COMBINED TEMPERATURE AND HUMIDITY

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
●Powers Regulator Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDERS, DRAFT

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Foxboro Co., Foxboro, Mass.
●Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Republic Flow Meters Co., Chicago, Ill.
Uehling Instrument Co., Paterson, N. J.
Wheelco Instruments Co., Chicago, Ill.

RECORDERS, HUMIDITY

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
H-B Instrument Co., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
●Powers Regulator Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDERS, LIQUID LEVEL

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.
Cochrane Corp., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.

● Advertisement in this issue. See Index to Advertisers, page 306.

Liquidometer Corp., Long Island City, N. Y.
Mason-Neilan Regulator Co., Boston, Mass.
Morey & Jones, Ltd., Los Angeles, Calif.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RECORDERS, PRESSURE AND VACUUM

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Cochrane Corp., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
●Hays Corp., Michigan City, Ind.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Uehling Instrument Co., Paterson, N. J.
●United States Gauge Co., New York, N. Y.

RECORDERS, TEMPERATURE

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Cochrane Corp., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Engelhard, Inc., Charles, Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
H-B Instrument Co., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Liquidometer Corp., Long Island City, N. Y.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
●Powers Regulator Co., Chicago, Ill.
Practical Instrument Co., Chicago, Ill.
Preferred Utilities Mfg. Corp., New York, N. Y.
Pyrometer Instrument Co., New York, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
Weksler Thermometer Corp., New York, N. Y.
Wheelco Instruments Co., Chicago, Ill.

RECORDING THERMOMETERS

See Recorders, Temperature

REDUCERS, SPEED

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Boston Gear Wks., Inc., North Quincy, Mass.
De Laval Steam Turbine Co., Trenton, N. J.
●General Electric Co., Schenectady, N. Y.
Graham Transmissions, Inc., Milwaukee, Wis.
Ideal Commutator Dresser Co., Sycamore, Ill.
Janette Mfg. Co., Chicago, Ill. (Motorized)
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Link-Belt Co., Philadelphia, Pa.
Medart Co., St. Louis, Mo.
Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.
Morse Chain Co., Ithaca, N. Y. (Chain speed)
Philadelphia Gear Works, Inc., Philadelphia, Pa.
Poole Foundry & Machine Co., Baltimore, Md.
Smith, Inc., Winfield H., Springville, N. Y.
Star Electric Motor Co., Bloomfield, N. J.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

REFRACTORIES AND REFRACTORY CEMENT

Babcock & Wilcox Co., New York, N. Y.
Botfield Refractories Co., Philadelphia, Pa.
Green Fire Brick Co., A. P., Mexico, Mo.
McLeod & Henry Co., Inc., Troy, N. Y.
Munn and Steele, Inc., Newark, N. J.
Plibrico Jointless Firebrick Co., Chicago, Ill.
Pyrolite Products Co., Cleveland, O.
Quigley Co., Inc., New York, N. Y.
Ramtite Co., The, Chicago, Ill.
Refractory & Insulation Corp., New York, N. Y.
Rex Clay Products Co., Detroit, Mich.
●Rutland Fire Clay Co., Rutland, Vt.
Standard Fuel Engineering Co., Detroit, Mich.
Universal Zonolite Insulation Co., Chicago, Ill.
Walsh Refractories Corp., St. Louis, Mo.

REFRIGERANT DEHYDRATORS

See Dehydrators, Refrigerant

REFRIGERANT GAS PURGERS

See Purgers, Refrigerant Gas

REFRIGERANTS

Ansul Chemical Co., Marinette, Wis. (methyl chloride, sulphur dioxide)
Armour Ammonia Wks., Chicago, Ill. (ammonia)
Carbide and Carbon Chemicals Corp., New York, N. Y. (Butane, isobutane, propane, ethane)
du Pont de Nemours & Co., Inc., E. I., Electrochemicals Dept., Wilmington, Del. (methyl chloride and methylene chloride, SO_2 trichlorethylene)
du Pont de Nemours & Co., National Ammonia Div., Wilmington, Del. (ammonia, sulphur dioxide, methyl chloride, "Freon-12")
Kinetic Chemicals, Inc., Wilmington, Del. ("Freon," fluorine)
Liquid Carbonic Corp., Chicago, Ill. (carbon dioxide)
Monsanto Chemical Co., Organic Chemicals Div., St. Louis, Mo. (Anhydrous Ammonia)
Pennsylvania Salt Mfg. Co., Philadelphia, Pa. (ammonia)
Pure Carbonic, Inc., New York, N. Y. (carbon dioxide)
Solvay Sales Corp., New York, N. Y.
Virginia Smelting Co., West Norfolk, Va. (Methyl chloride, liquid sulphur dioxide, methylene chloride)

REFRIGERATING COMPRESSORS

See Compressors, Refrigerating

REFRIGERATION ACCUMULATORS

See Accumulators, Refrigeration

REFRIGERATION CONTROLS

See Valves, Refrigeration

REFRIGERATION FITTINGS

See Fittings, Refrigeration

REFRIGERATION MANIFOLDS

See Manifolds, Refrigeration

REFRIGERATION VALVES

See Valves, Refrigeration

REGISTERS

See also Diffusers, and Grilles

Air Control Products, Inc., Coopersville, Mich.
AirO-Fin Register Co., Detroit, Mich.
●Auer Register Co., Cleveland, O.
●Barber-Colman Co., Rockford, Ill.
Best Register Co., Milwaukee, Wis.
Char-Gale Mfg. Co., Minneapolis, Minn.
Davies Air Filter Corp., New York, N. Y.
Diamond Mfg. Co., Wyoming, Pa.
Elsey Metal Specialties Co., Detroit, Mich.
Empire Ventilation Equipment Co., Long Island City, N. Y.
Gillian Mfg. Co., Detroit, Mich.
Hart & Cooley Mfg. Co., Holland, Mich.
Hendrick Mfg. Co., Carbondale, Pa.
Independent Register Co., Cleveland, O.
Knowles Mushroom Ventilator Co., Montclair, N. J.
Lamneck Products, Inc., Middletown, O.
Middleton Mfg. & Sales Co., Minneapolis, Minn.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Newman Bros., Inc., Cincinnati, O.
Pacific Airmax Corp., Huntington Park, Cal.
Palmer Mfg. Corp., Phoenix, Ariz.
Register & Grille Mfg. Co., Brooklyn, N. Y.
Roberts-Hamilton Co., Minneapolis, Minn.
Rock Island Register Co., Rock Island, Ill.
●Standard Stamping & Perforating Co., Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 306.

Stewart Mfg. Co., Orange, N. J.
•Tuttle & Bailey, Inc., New Britain, Conn.
United States Register Co., Battle Creek, Mich.
Waterloo Register Co., Waterloo, Ia.

REGULATORS, AIR VELOCITY

•Barber-Colman Co., Rockford, Ill.
•Johnson Service Co., Milwaukee, Wis.
•Powers Regulator Co., Chicago, Ill.
Wheelco Instruments Co., Chicago, Ill.

REGULATORS, DAMPER SETS

Adams Co., The, Dubuque, Ia.
Air Control Products, Inc., Coopersville, Mich.
•Barber-Colman Co., Rockford, Ill.
Cole-Sullivan Engineering Co., Minneapolis, Minn.
Fossum, M. H., St. Paul, Minn.
Gerett Corp., M. A., Milwaukee, Wis.
Goese Mfg. Co., Milwaukee, Wis.
Hart & Cooley Mfg. Co., Holland, Mich.
Joal Mfg. Corp., Toledo, O.
Kerentoff, G. L., Cincinnati, O.
Martens & Stormoen, Boston, Mass.
•Mercoid Corp., The, Chicago, Ill.
•Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Northern Weatherstrip Co., Duluth, Minn.
Parker-Kalon Corp., New York, N. Y.
•Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Sampsel Time Control, Inc., Spring Valley, Ill.
Thrush & Co., H. A., Peru, Ind.
United States Register Co., Battle Creek, Mich.
Young Regulator Co., Cleveland, O.

REGULATORS, DRAFT, COMBUSTION

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Askania Regulator Co., Chicago, Ill.
Au-Temp-Co Corp., New York, N. Y.
Automatic Products Co., Milwaukee, Wis.
Bailey Meter Co., Cleveland, O.
Boiler Room Equipment, Inc., New York, N. Y.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burrows Mfg. Co., F. A., York, Pa.
•Cash Co., A. W., Decatur, Ill.
Cole-Sullivan Engineering Co., Minneapolis, Minn.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Engineer Co., New York, N. Y.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Gilbert & Barker Mfg. Co., West Springfield, Mass.
Hagan Corp., Pittsburgh, Pa.
•Hays Corp., Michigan City, Ind.
Hotstream Heater Co., Cleveland, O.
•Illinois Engineering Co., Chicago, Ill.
•Kieley & Mueller, Inc., North Bergen, N. J.
Leeds & Northrup Co., Philadelphia, Pa.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
•Mercoid Corp., The, Chicago, Ill.
•Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Brass Co., Grand Rapids, Mich.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Precision Control Co., San Francisco, Cal.
•Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Republic Flow Meters Co., Chicago, Ill. (Industrial)
Ruggles-Klingeman Mfg. Co., Salem, Mass.
Russell Electric Co., Chicago, Ill.
Sampsel Time Control, Inc., Spring Valley, Ill.
Schade Valve Mfg. Co., Philadelphia, Pa.
Shallcross Controls. Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
•Webster Engineering Co., Tulsa, Okla.
Wheelco Instruments Co., Chicago, Ill.

REGULATORS, PRESSURE, AIR

American Meter Co., Inc., New York, N. Y.
Askania Regulator Co., Chicago, Ill.
Atlas Valve Co., Inc., Newark, N. J.
•Barber-Colman Co., Rockford, Ill.
Belfield Co.. H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Brooke Engineering Co., Inc., Philadelphia, Pa.
•Cash Co., A. W., Decatur, Ill.
Cooper Co., Clark, Palmyra, N. J.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
DeVilbiss Co., The, Toledo, O.
Dockson Corp., Detroit, Mich.
•Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
•Fulton Sylphon Co., The, Knoxville, Tenn.
Grove Regulator Co., Oakland, Cal.
Hagan Corp., Pittsburgh, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
•Illinois Engineering Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.
Klipfel Mfg. Co., Chicago. Ill.
Leslie Co., Lyndhurst, N. J.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
•Mercoid Corp., The, Chicago, Ill.
Milburn Co., Alexander, Baltimore, Md.
Modern Engineering Co., St. Louis, Mo.
Monitor Controller Co., The, Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
National Cylinder Gas Co., Chicago, Ill.
Norgren Co., C. A., Denver, Colo.
•Penn Electric Switch Co., Goshen, Ind.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
•R-S Products Corp., Philadelphia, Pa.
•Reading-Pratt & Cady Div., American Chain & Cable Co. Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Spray Engineering Co., Somerville, Mass.
Square D Co., Detroit, Mich.
Square D Co., Industrial Controller Div., Milwaukee, Wis.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Torchweld Equipment Div., National Cylinder Gas Co., Chicago Ill.
Trerice Co., H. O., Detroit, Mich.
Tryco Products, Inc., Westfield, Mass.
United Electric Controls Co., Boston, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Wheelco Instruments Co., Chicago, Ill.
•White-Rodgers Electric Co., St. Louis, Mo.

REGULATORS, PRESSURE, GAS

American Meter Co., Inc., New York, N. Y.
Askania Regulator Co., Chicago, Ill.
Atlas Valve Co., Inc., Newark, N. J.
•Barber-Colman Co., Rockford, Ill.
Barber Gas Burner Co., Cleveland, O.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
•Cash Co., A. W., Decatur, Ill.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Palmyra, N. J.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Dockson Corp., Detroit, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
•Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Fox Control & Mfg. Co., Cleveland, O.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson. Md.
•General Controls Co., Glendale, Cal.
Grove Regulator Co., Oakland, Cal.
Hagan Corp., Pittsburgh, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
•Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
•Kieley & Mueller, Inc., North Bergen, N. J.
Klipfel Mfg. Co., Chicago. Ill.
Leslie Co., Lyndhurst, N. J.
Liquid Carbonic Corp., The, Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
•Mercoid Corp., The, Chicago, Ill.
Milburn Co., Alexander, Baltimore, Md.
Modern Engineering Co., St. Louis, Mo.
Monitor Controller Co., The, Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
National Cylinder Gas Co., Chicago, Ill.
Norgren Co., C. A., Denver, Col.
Pacific Airmax Corp., Huntington Park, Cal.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
•Powers Regulator Co., Chicago, Ill.
•R-S Products Corp., Philadelphia, Pa.
•Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Republic Flow Meters Co., Chicago, Ill. (Industrial)
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.

• Advertisement in this issue. See Index to Advertisers, page 306.

Shallcross Controls, Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Square D Co., Detroit, Mich.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.
Trerice Co., H. O., Detroit, Mich.
Watson & McDaniel Co., Philadelphia, Pa.
Wheelco Instruments Co., Chicago, Ill.

REGULATORS, PRESSURE, HOT WATER HEATING SYSTEMS

●Barber-Colman Co., Rockford, Ill.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
●Bell & Gossett Co., Morton Grove, Ill.
●Fisher Governor Co., Marshalltown, Ia.
●Hoffman Specialty Co., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Kainer Co., Chicago, Ill.
Kehm Corp., The, Chicago, Ill.
●Mercoid Corp., The, Chicago, Ill.
Mueller Co., Decatur, Ill.
Penberthy Injector Co., Detroit, Mich.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Schade Valve Mfg. Co., Philadelphia, Pa.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.
Wheelco Instruments Co., Chicago, Ill.
●White-Rodgers Electric Co., St. Louis, Mo.

REGULATORS, PRESSURE, LIQUID

Atlas Valve Co., Inc., Newark, N. J.
Automatic Control Co., St. Paul, Minn.
Bailey Meter Co., Cleveland, O.
●Barber-Colman Co., Rockford, Ill.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Palmyra, N. J.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
General Sales & Products Co., Cohoes, N. Y.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Grove Regulator Co., Oakland, Cal.
Hagan Corp., Pittsburgh, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
Healy Ruff Co., St. Paul, Minn.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Justus Steam Trap Co., Napanoch, N. Y.
Keckley Co., O. C., Chicago, Ill.
●Kieley & Mueller, Inc., North Bergen, N. J.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
●Mercoid Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Monitor Controller Co., The, Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Norgren Co., C. A., Denver, Colo.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
●Powers Regulator Co., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Republic Flow Meters Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schaub Engineering Co., Fred H., Chicago, Ill.
Shallcross Controls, Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Square D Co., Detroit, Mich.
Square D Co., Industrial Controller Div., Milwaukee, Wis.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Tryco Products, Inc., Westfield, Mass.
United Electric Controls Co., Boston, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
Wheelco Instruments Co., Chicago, Ill.
●White-Rodgers Electric Co., St. Louis, Mo.
Williams Gauge Co., Pittsburgh, Pa. (Feed water)

REGULATORS, STATIC PRESSURE, AIR DUCT

●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
●Cash Co., A. W., Decatur, Ill.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.

REGULATORS, TEMPERATURE

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Armstrong Heat Control Co., Portland, Ore.
Atlas Valve Co., Inc., Newark, N. J.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burling Instrument Co., Newark, N. J.
Cook Electric Co., Chicago, Ill.
Cooper Co., Clark, Palmyra, N. J.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C A., Chicago, Ill.
Eastern Engineering Co., New Haven, Conn.
Eclipse Fuel Engineering Co., Rockford, Ill.
Edison, Inc., Thomas A., Instrument Div., West Orange, N. J.
Electrimatic Div., The, of the Simoniz Co., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●Fulton Sylphon Co., Knoxville, Tenn.
●General Controls Co., Glendale, Cal.
H-B Instrument Co., Philadelphia, Pa.
Hagan Corp., Pittsburgh. Pa.
Hart Mfg. Co., The, Hartford, Conn.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Keckley Co., O. C., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Marsh Corp., Jas. P., Chicago, Ill.
Marsh Tritrol Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
McCorkle Co., D. H., Berkeley, Cal.
●Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
●Powers Regulator Co., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Pyrometer Instrument Co., New York, N. Y.
Ranco, Inc., Columbus, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Detroit, Mich.
Sterling, Inc., Milwaukee, Wis.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Triplex Heating Specialty Co., Peru, Ind.
United Electric Controls Co., Boston, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Watson & McDaniel Co., Philadelphia, Pa.
Wheelco Instruments Co., Chicago, Ill.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.

RELAYS, ELECTRICAL

Advance Electric Co., Los Angeles, Cal.
Allen-Bradley Co., Milwaukee, Wis.
American Instrument Co., Silver Spring, Md.
●Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Au-Temp-Co Corp., New York, N. Y.
Automatic Switch Co., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.

● Advertisement in this issue. See Index to Advertisers, page 306.

Bardco Mfg. & Sales Co., Los Angeles, Cal.
Bender Warrick Corp., Birmingham, Mich.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Boston Auto Gage Co., Pittsfield, Mass.
Clark Controller Co., Cleveland, O.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Cook Electric Co., Chicago, Ill.
Cramer Co., Inc., R. W., The, Centerbrook, Conn.
Cutler-Hammer, Inc., Milwaukee, Wis.
Davis & Co., Inc., Dean W., Chicago, Ill.
Detroit Lubricator Co., Detroit, Mich.
Dunn, Inc., Struthers, Philadelphia, Pa.
Durakool, Inc., Elkhart, Ind.
Edison, Inc., Thos. A., Instrument Div., West Orange, N. J.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
Guardian Electric Mfg. Co., Chicago, Ill.
H-B Instrument Co., Philadelphia, Pa.
Hart Mfg. Co., Hartford, Conn.
Industrial Engineering Corp., Terre Haute, Ind.
Jefferson Electric Co., Bellwood, Ill.
Magnet Switch Co., Chicago, Ill.
McCorkle Co., D. H., Berkeley, Calif.
●Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
National Time & Signal Corp., Detroit, Mich.
●Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Philadelphia Thermometer Co., Philadelphia, Pa.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Sampsel Time Control, Inc., Spring Valley, Ill.
Small Motors, Inc., Chicago, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Milwaukee, Wis.
Struthers Dunn, Inc., Philadelphia, Pa.
Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Heating Specialty Co., Peru, Ind.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N. J.
●White-Rodgers Electric Co., St. Louis, Mo.
Zenith Electric Co., Chicago, Ill.

RELIEF VALVES

See Valves, Relief

REPAIR CLAMPS

See Clamps, Pipe Repair

RESEATERS, VALVE

Leavitt Machine Co., Orange, Mass.
Standard Reseater Corp., New York, N. Y.

RINGS, PISTON, FOR COMPRESSORS

American Hammered Piston Ring Div., Koppers Co., Baltimore, Md.
McQuay-Norris Mfg. Co., St. Louis, Mo.
Perfect Circle Co., The, Hagerstown, Ind.
Perfection Refrigeration Parts Co., Harvey, Ill.
Sealed Power Corp., Muskegon, Mich.

RINGS, WELDING

●Tube-Turns, Louisville, Ky.

ROD, GAS WELDING

●Air Reduction Sales Co., New York, N. Y.
American Agile Corp., Cleveland, O.
●American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Cleveland, O.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Steel & Wire Co., Chicago, Ill.
Crucible Steel Co. of America, New York, N. Y.
Duraloy Co., Scottdale, Pa. (Stainless)
Eutectic Welding Alloys Co., New York, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
●International Nickel Co., New York, N. Y.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Liquid Carbonic Corp., The, Chicago, Ill.
Maurath, Inc., Cleveland, O.
Milburn Co., Alexander, Baltimore, Md.
Modern Engineering Co., St. Louis, Mo.
National Cylinder Gas Co., Chicago, Ill.
Page Steel & Wire Division of American Chain & Cable Co., Inc., Monessen, Pa.
Republic Steel Corp., Cleveland, O.
Revere Copper and Brass, Incorporated, New York, N. Y.
Seneca Wire & Mfg. Co., Fostoria, O.
Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.
Universal Power Corp., Cleveland, O.
Wickwire Spencer Steel Co., New York, N. Y.
●Youngstown Sheet & Tube Co., Youngstown, O.

ROLLER BEARINGS

See Bearings, Roller

ROOF COOLERS

See Systems, Roof Spraying

ROOF SPRAYING SYSTEMS

See Systems, Roof Spraying

ROOF VENTILATORS

See Ventilators, Roof

ROOM HUMIDIFIERS

See Humidifiers, Unit, Room Type; and Units, Air Conditioning, Comfort, Winter

ROOM THERMOSTATS

See Thermostats, Room or Wall

ROTARY PUMPS

See Pumps, Rotary

RUBBER BELTING

See Belting, Flat, Rubber

RUBBER PACKING

See Packing, Rubber and Synthetic

RUBBER PIPE

See Pipe, Hard Rubber

SADDLE VALVES

See Valves, Saddle

SAFETY VALVES

See Valves, Safety, Steam

SCREENS, SUN REFLECTING

Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago, Ill.

SEAMLESS PIPE

See Pipe, Steel, Seamless

SEPARATORS, AIR

Adams Co., Inc., R. P., Buffalo, N. Y.
American Injector Co., Detroit, Mich.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Centrifix Corp., Cleveland, O.
Cochrane Corp., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
DeVilbiss Co., The, Toledo, O.
Hagan Corp., Pittsburgh, Pa.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Keckley Co., O. C., Chicago, Ill.
Leavitt Machine Co., Orange, Mass.
Milburn Co., Alexander, Baltimore, Md.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Spencer Turbine Co., Hartford, Conn.
Spray Engineering Co., Somerville, Mass.
●Staynew Filter Corp., Rochester, N. Y.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Textite Corp., Chicago, Ill.
Trerice Co., H. O., Detroit, Mich.
Wright-Austin Co., Detroit, Mich.

SEPARATORS, STEAM AND OIL

●Acme Industries, Inc., Jackson, Mich.
Adams Co., Inc., R. P., Buffalo, N. Y,
●American District Steam Co., North Tonawanda, N. Y.
Barrett Machine Co., N. S., Pittsburgh, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Cochrane Corp., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Elliott Co., Jeannette, Pa.
●Fisher Governor Co., Marshalltown, Ia.
Frick Co., Waynesboro, Pa.

● Advertisement in this issue. See Index to Advertisers, page 306.

Hagan Corp., Pittsburgh, Pa.
Hoppes Mfg. Co., Springfield, O.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
●Kieley & Mueller, Inc., North Bergen, N. J.
Kisco Boiler & Engineering Co., St. Louis, Mo.
McAlear Mfg. Co., Chicago, Ill.
Morehead Mfg. Co., Detroit, Mich.
National Valve & Mfg. Co., Pittsburgh, Pa.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Schutte & Koerting Co., Philadelphia, Pa.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Textite Corp., Chicago, Ill.
●Webster & Co., Warren, Camden, N. J.
Westfalia Separator Co., Bloomfield, N. J.
●Worthington Pump & Machinery Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.
Wright-Austin Co., Detroit, Mich.

SEWAGE EJECTORS

See Ejectors, Sewage

SHEARS, ELECTRIC, PORTABLE

Black & Decker Mfg. Co., Towson, Md.
G. D. S. Machinery & Supply Co., Inc., New York, N. Y.
Independent Pneumatic Tool Co., Chicago, Ill.
●O'Neil Irwin Mfg. Co., Inc., Minneapolis, Minn.
Skilsaw, Inc., Chicago, Ill.
Stanley Electric Tool Div., The Stanley Works, New Britain, Conn.
Van Dorn Electric Tool Co., Towson, Md.

SHEARS, POWER

Beatty Machine & Mfg. Co., Hammond, Ind.
Bertsch & Co., Inc., Cambridge City, Ind.
Bliss Co., E. W., Toledo, O.
●Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Heartley Machine & Tool Co., Toledo, O.
Hendley & Whittemore, Beloit, Wis.
Niagara Machine & Tool Wks., Buffalo, N. Y.
●O'Neil Irwin Mfg. Co., Inc., Minneapolis, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Quickwork-Whiting Div. of Whiting Corp., Harvey, Ill.
Rafter Machine Co., Belleville, N. J.
Rock River Machine Co., Inc., Janesville, Wis.
Whitney Metal Tool Co., Rockford, Ill.
Yoder Co., The, Cleveland, O.

SHEARS AND SNIPS, HAND

Armstrong-Blum Mfg. Co., Chicago, Ill.
Bartlett Mfg. Co., Detroit, Mich.
Beverly Throatless Shear Co., Chicago, Ill.
Bremil Mfg. Co., Erie, Pa.
Clauss Shear Co., Fremont, O.
Crescent Tool Co., Jamestown, N. Y.
Excelsior Tool & Machine Co., East St. Louis, Ill.
G. D. S. Machinery & Supply Co., Inc., New York, N. Y.
Grobet File Corp. of America, New York, N. Y.
Hendley & Whittemore, Beloit, Wis.
Kidder Mfg. Co., Inc., J. F., Burlington, Vt. (Angle)
Marshalltown Mfg. Co., Marshalltown, Ia.
Niagara Machine & Tool Wks., Buffalo, N. Y.
●O'Neil Irwin Mfg. Co., Inc., Minneapolis, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Rafter Machine Co., Belleville, N. J.
Service Machine Co., Elizabeth, N. J.
Snap-On Tools Corp., Kenosha, Wis.
Viking Shear Co., Erie, Pa.
Whitney Metal Tool Co., Rockford, Ill.
Wiss & Sons Co., J., Newark, N. J.

SHEAVES

See Pulleys and Sheaves, for Belt Drives

SHEET METAL BRAKES

See Brakes, Sheet Metal

SHEET METAL DUCTS

See Ducts and Duct Fittings, Prefabricated

SHEET METAL FITTINGS

See Ducts and Duct Fittings, Prefabricated

SHEET METAL PUNCHES

See Punches, Sheet Metal

SHEETS, ALUMINUM

Aluminum Co. of America, Pittsburgh, Pa.
American Nickeloid Co., Peru, Ill. (Nickel and chromium plated)
Fairmont Aluminum Co., Fairmont, W. Va.

SHEETS AND BOARD, NON-METALLIC, FOR DUCT CONSTRUCTION

●Carey Mfg. Co., Philip, Cincinnati, O.
Celotex Corp., The, Chicago, Ill.
●Grant Wilson, Inc., Chicago, Ill.
●Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa
Keystone Asphalt Products Co., Chicago, Ill.
Masonite Corp., Chicago, Ill.
Ruberoid Co., New York, N. Y.
●Sall Mountain Co., Chicago, Ill.
United States Gypsum Co., Chicago, Ill.
●Wilson, Inc., Grant, Chicago, Ill.

SHEETS, CLAD

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Aluminum Co. of America, Pittsburgh, Pa.
General Plate Div., Metals & Controls Corp., Attleboro, Mass
Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago, Ill.
Jessop Steel Co., Washington, Pa.
Lukens Steel Co., Coatesville, Pa.

SHEETS, COPPER

●American Brass Co., Waterbury, Conn.
American Nickeloid Co., Peru, Ill. (Nickel and chromium plated)
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Conklin Brass & Copper Co., Inc., T. E., New York, N. Y.
Downs-Smith Brass & Copper Co., New York, N. Y.
●Hussey & Co., C. G., Pittsburgh, Pa.
National Brass & Copper Co., Inc., Lisbon, O.
New Haven Copper Co., Seymour, Conn.
Revere Copper and Brass, Incorporated, New York, N. Y.
United States Brass & Copper Co., Hyde Park, Boston, Mass
●Western Cartridge Co., Brass Mill Div., East Alton, Ill. (Brass bronze, phosphor bronze)

SHEETS, LEAD

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
●American Smelting & Refining Co., New York, N. Y.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Downs-Smith Brass & Copper Co., New York, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.
Revere Copper and Brass Incorporated, New York, N. Y.
Rochester Lead Wks., Rochester, N. Y.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

SHEETS, METAL, WITH PROTECTIVE NON-METALLIC COATING

Cheney Metal Products Co., Trenton, N. J.

SHEETS, NICKEL AND NICKEL ALLOY

American Nickeloid Co., Peru, Ill.
Duriron Co., Inc., Dayton, O. (acid resisting)
General Plate Div., Metals & Controls Corp., Attleboro, Mass
●International Nickel Co., New York, N. Y.
Republic Steel Corp., Cleveland, O.
Revere Copper and Brass Incorporated, New York, N. Y.
●Western Cartridge Co., Brass Mill Div., East Alton, Ill.

SHEETS, STEEL, COPPER BEARING

●American Rolling Mill Co., The, Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Columbia Steel Co. (Sub. United States Steel Corp.), San Francisco, Cal.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., Chicago, Ill.
Lukens Steel Co., Coatesville, Pa.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Newport, Ky.
Reeves Steel & Mfg. Co., Dover, O.
●Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., The, Canton, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

Weirton Steel Co., Weirton, W. Va.
Wheeling Corrugating Co., Wheeling, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
●Youngstown Sheet & Tube, Co., Youngstown, O.

SHEETS, STEEL, GALVANIZED

●American Rolling Mill Co., The, Middletown, O.
Apollo Steel Co., Apollo, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Columbia Steel Co. (Sub. United States Steel Corp.), San Francisco, Cal.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, New York, N. Y.
Empire Sheet & Tin Plate Co., Mansfield, O.
Granite City Steel Co., Granite City, Ill.
Great Lakes Steel Corp., Detroit, Mich.
Inland Steel Co., Chicago, Ill.
Lukens Steel Co., Coatesville, Pa.
Lyon, Conklin & Co., Inc., Baltimore, Md.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Newport, Ky.
Niles Rolling Mill Co., Niles, O.
Parkersburg Iron & Steel Co., Parkersburg, W. Va
Reeves Steel & Mfg. Co., Dover, O.
Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., The, Canton, O.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Wheeling Corrugating Co., Wheeling, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
Wood Steel Co., Alan, Conshohocken, Pa.
●Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS, STEEL, GALVANNEALED

Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Continental Steel Corp., Kokomo, Ind.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Newport, Ky.
Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., The, Div. of Continental Steel Corp., Canton, O.
●Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS, STEEL, STAINLESS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
●American Rolling Mill Co., The, Middletown, O.
Barium Stainless Steel Corp., Canton, O.
Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Colonial Alloys Co., Metals Div., Philadelphia, Pa.
Granite City Steel Co., Granite City, Ill.
Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago, Ill.
Jessop Steel Co., Washington, Pa.
Lukens Steel Co., Coatesville, Pa.
Republic Steel Corp., Cleveland, O.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Sharon Steel Corp., Sharon, Pa.
Superior Steel Corp., Pittsburgh, Pa.
Universal-Cyclops Steel Corp., Bridgeville, Pa.

SHEETS, WROUGHT IRON

●Byers Co., A. M., Pittsburgh, Pa.

SHEETS, ZINC

American Nickeloid Co., Peru, Ill. (Nickel and chromium plated)
American Zinc Products Co., Greencastle, Ind.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Downs-Smith Brass & Copper Co., New York, N. Y.
Hegeler Zinc Co., Danville, Ill.
Illinois Zinc Co., Chicago, Ill.
Matthiessen & Hegeler Zinc Co., La Salle, Ill.
New Jersey Zinc Sales Co., New York, N. Y.

SHUTTERS

See Louvers and Shutters

SIGHT GLASSES

See Glasses, Sight, for Pipe Lines

SLEEVE BEARINGS

See Bearings, Sleeve

SMOKE ALARMS

See Alarms, Smoke

SMOKE GUNS

See Guns and Pots, Smoke and Smudge

SMUDGE POTS

See Guns and Pots, Smoke and Smudge

SOCKET WRENCHES

See Wrenches, Socket

SOLAR HEAT RESISTING SCREENS

See Screens, Sun Reflecting

SOLDER (SILVER), BRAZING ALLOYS, AND FLUXES

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
●American Smelting & Refining Co., New York, N. Y.
Chase Brass & Copper Co., Waterbury, Conn.
Eutectic Welding Alloys Co., New York, N. Y.
General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Handy & Harman, New York, N. Y.
Hardy, Inc., Charles, New York, N. Y.
Industrial Service Laboratories, Milwaukee, Wis.
Johnson Co., Lloyd S., Chicago, Ill.

SOLDER (TIN-LEAD), AND FLUXES

●Air Reduction Sales Co., New York, N. Y.
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
●American Brass Co., Waterbury, Conn.
●American Smelting & Refining Co., New York, N. Y.
American Solder & Flux Co., Philadelphia, Pa.
Belmont Smelting & Refining Works, Inc., Brooklyn, N. Y.
Benson Co., Inc., Alex R., Hudson, N. Y.
Burnley Battery & Mfg. Co., North East, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Gardiner Metal Co., Chicago, Ill.
Glaser Lead Co., Inc., Brooklyn, N. Y.
Hercules Chemical Co., Inc., New York, N. Y.
Industrial Service Laboratories, Milwaukee, Wis.
Johnson Co., Lloyd S., Chicago, Ill.
Kester Solder Co., Chicago, Ill.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Lissberger & Son, Inc., Long Island City, N. Y.
Merchant & Evans Co., Philadelphia, Pa.
National Lead Co., New York, N. Y.
Rochester Lead Works, Inc., Rochester, N. Y.
Ruby Chemical Co., Columbus, O.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.
Utility Laboratory, Inc., Brooklyn, N. Y.

SOLENOID VALVES

See Valves, Solenoid

SOOT BLOWERS

See Blowers, Soot

SOOT DESTROYERS

See Destroyers, Soot, Chemical

SOUND DEADENING FOR CEILING AND WALL

See Insulation, Ceiling and Wall, Sound Deadening

SOUND DEADENING FOR DUCTS

See Insulation, Duct, Sound Deadening

SOUND INDICATORS

See Indicators, Sound Level

SPEED CHANGERS

See Changers, Speed, Hydraulic Coupling; Changers, Speed, Mechanical

SPEED REDUCERS

See Reducers, Speed

SPIRAL PIPE

See Pipe, Spiral, Riveted and Welded

SPOT WELDERS

See Welders, Spot

SPRAY HUMIDIFIERS

See Humidifiers, Direct, Spray Head

● Advertisement in this issue. See Index to Advertisers, page 306.

SPRAY NOZZLES
See Nozzles, Spray

SPRAY PAINTING BOOTHS
See Booths, Painting, Spray

SPRINKLER HEADS
See Heads, Sprinkler

SPRINKLER SYSTEM CONTROLS
See Controls, Fire Protection Sprinkler Systems; Valves, Fire Protection Sprinkler System Control

STAINLESS STEEL PIPE
See Pipe, Steel, Stainless

STAINLESS STEEL SHEETS
See Sheets, Steel, Stainless

STANDS, PIPE VISE
American Pipe Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Crown Die & Tool Co., Chicago, Ill.
Hollands Mfg. Co., Erie, Pa.
Martin & Sons, H. P., Owensboro, Ky.
Nye Tool & Machine Wks., The, Chicago, Ill.
Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.
Western Wire Products Co., St. Louis, Mo.
● Williams & Co., J. H., Buffalo, N. Y.

STEAM BOOSTER COMPRESSORS
See Compressors, Steam Booster

STEAM ENGINES
See Engines, Steam

STEAM JET REFRIGERATION
See Compressors, Refrigerating, Steam Jet

STEAM PRESSURE REGULATORS
See Valves, Pressure Reducing and Regulating

STEAM PUMPS
See Pumps, Steam

STEAM SEPARATORS
See Separators, Steam and Oil

STEAM TRAPS
See Traps, Steam

STEEL PIPE
See Pipe, Steel

STEEL TUBING
See Tubing, Steel

STEEL UNIONS
See Unions, Steel

STEEL VALVES
See Valves, Gate; and Valves, Globe

STERILIZING LAMPS
See Lamps, Sterilizing, for Duct Installation

STOCKS AND DIES
American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Champion Blower & Forge Co., Lancaster, Pa.
Crown Die & Tool Co., Chicago, Ill. (Pipe)
Erie Tool Wks., Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
Jarecki Mfg. Co., Erie, Pa.
Nye Tool & Machine Wks., The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.

STOKERS, INDUSTRIAL AND COMMERCIAL
61 to 1200 Lb per Hr

American Coal Burner Co., Chicago, Ill.
American Engineering Co., Philadelphia, Pa.
Anchor Stove & Range Co., New Albany, Ind.
Auburn Foundry, Inc., Stoker Div., Auburn, Ind.
Babcock & Wilcox Co., New York, N. Y.
Bluffton Mfg. Co., The, Findlay, O.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
Burke Stoker & Mfg. Co., Chicago, Ill.
Burnham Stoker Co., Vancouver, Wash.
Canton Stoker Corp., Canton, O.
Carnes, Inc., John R., Lima, O.
Chesapeake & Ohio R. R. Co., Cleveland, O.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Columbus Metal Products, Inc., Columbus, O.
Combustion Engineering Co., Inc., New York, N. Y.
Conco Corp., Div. of H. D. Conkey & Co., Mendota, Ill.
● Crane Co., Chicago, Ill.
Crown Iron Works, Minneapolis, Minn.
Detroit Stoker Co., Detroit, Mich.
Econocol Stoker Div. of Cotta Transmission Corp., Rockford, Ill.
Eddy Stoker Corp., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Firemood Machine Wks., Converse, Ind.
Flynn & Emrich Co., Baltimore, Md.
● Frederick Iron & Steel Co., Frederick, Md.
Fuel Savers, Inc., Harrisburg, Pa.
Gehl Bros. Mfg. Co., West Bend, Wis.
General Machinery Co., Spokane, Wash.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Heating Assurance, Inc., Spokane, Wash.
Her-Born Engrg. & Mfg. Co., Sandusky, O.
Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.
Hoffman Combustion Engineering Co., Detroit, Mich.
Holcomb & Hoke Mfg. Co., Indianapolis, Ind.
Illinois Iron & Bolt Co., Chicago, Ill.
International Engineering Wks., Inc., Framingham, Mass.
Iron Fireman Mfg. Co., Cleveland, O.
Kingston Products Corp., Kokomo, Ind.
Kol-Master Corp., Oregon, Ill.
Laclede Stoker Co., St. Louis, Mo.
Leffel & Co., Springfield, O.
Link-Belt Co., Chicago, Ill.
"Loyal Knight" Stokers, Inc., Belleville, Ill.
Mallory Sales Co., Dolton, Ill.
Muncie Gear Wks., Inc., Muncie, Ind.
National Steam Pump Co., Upper Sandusky, O.
Neemes Foundry, Inc., Troy, N. Y.
Northern Steel and Stoker Corp., Peoria, Ill.
Ormsby-Osterman, Inc., St. Louis, Mo.
Orr & Sembower, Inc., Reading, Pa.
● Peerless Mfg. Corp., Louisville, Ky.
Perfection Grate & Stoker Co., Springfield, Mass.
Riley Stoker Corp., Worcester, Mass.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Schwitzer-Cummins Co, Indianapolis, Ind.
Scott-Newcomb, Inc., St. Louis, Mo.
Sinker-Davis Co., Indianapolis, Ind.
Steel Products Engineering Co., Springfield, O.
Stok-A-Fire Co., University City, Mo.
Stokermatic Co., Salt Lake City, Utah.
Sun-Fire Stoker Corp., New Albany, Ind.
U. S. Machine Corp., Lebanon, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Whiting Stoker Co., Chicago, Ill.
Will-Burt Co., The Orrville, O.

STONEWARE PIPE
See Pipe, Stoneware

● Advertisement in this issue. See Index to Advertisers, page 306.

STORAGE WATER HEATERS

See Heaters, Water, Steam, Storage

STRAINERS, PIPE LINE

Alten's Foundry & Machine Works, Lancaster, O.
●American District Steam Co., North Tonawanda, N. Y.
American Injector Co., Detroit, Mich.
●Anderson Co., V. D., The, Cleveland, O.
●Automatic Products Co., Milwaukee, Wis.
Barrett, Haentjens & Co., Hazleton, Pa.
Bishop & Babcock Mfg. Co., Cleveland, O.
Blackmer Pump Co., Grand Rapids, Mich.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Boylston Steam Specialty Co., Chicago, Ill.
Buffalo Meter Co., Buffalo, N. Y.
●Cash Co., A. W., Decatur, Ill.
Cashin Co., W. D., Boston, Mass.
Central Brass Mfg. Co., Cleveland, O.
●Crane Co., Chicago, Ill.
Cuno Engineering Corp., Meriden, Conn.
Davis Regulator Co., Chicago, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Elliott Co., Jeannette, Pa.
●Fisher Governor Co., Marshalltown, Ia.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Foster Engineering Co., Newark, N. J.
Foster Pump Works, Inc., Brooklyn, N. Y.
●General Controls Co., Glendale, Cal.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
●Grinnell Co., Providence R. I.
●Hoffman Specialty Co., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kaye & MacDonald, Inc., West Orange, N. J.
Keckley Co., O. C., Chicago, Ill.
●Kieley & Mueller, Inc., North Bergen, N. J.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Leslie Co., Lyndhurst, N. J
Maid-O'-Mist, Inc., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
●Mueller Brass Co., Port Huron, Mich.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Long Island City, N. Y.
Newark Wire Cloth Co., Newark, N. J.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Phillips & Co., H. A., Chicago, Ill.
Preferred Utilities Mfg. Corp., New York, N. Y.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., New York, N. Y.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
Sheffler-Gross Co., Philadelphia, Pa.
Spence Engineering Co., Walden, N. Y.
Spray Engineering Co., Somerville, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Sterling, Inc., Milwaukee, Wis.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
●Trane Co., The, La Crosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Trimount Rotary Power Co., East Dedham, Mass.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.
Zallea Brothers & Johnson, Wilmington, Del.

STRESS RELIEVERS

See Preheaters and Stress Relievers, Electric, for Pipe Welds

STRIP HEATERS

See Heaters, Strip and Immersion, Electric

STRUCTURAL SHAPES

See Angles, Bars, Beams, Channels and Tees

SUMP PUMPS

See Pumps, Sump

SUPERHEATERS, PROCESS STEAM

●Bell & Gossett Co., Morton Grove, Ill.
Edge Moore Iron Works, Inc., New York, N. Y.
Foster Wheeler Corp., New York, N. Y.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Selas Co., The, Philadelphia, Pa.

SURFACE, FINNED, COOLING, BRINE

●Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
American Coils, Inc., Newark, N. J.
Baltimore Air Coil Co., Baltimore, Md.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
●Bush Mfg. Co., Hartford, Conn.
Conditionaire Unit Co., Chicago, Ill.
Drayer & Hanson, Inc., Los Angeles, Cal.
●G. & O. Mfg. Co., New Haven, Conn.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Griscom-Russell Co., The, New York, N. Y.
Industrial Mfg. & Engineering Co., Chicago, Ill.
●Kramer Trenton Co., Trenton, N. J.
●Marlo Coil Co., St. Louis, Mo.
●McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
●Murray Mfg. Co., D. J., Wausau, Wis.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
●Trane Co., The, La Crosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
Wolverine Tube Div. of Calumet and Hecla Consolidated Copper Co., Detroit, Mich.
XL Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE, FINNED, COOLING, COLD WATER

●Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
Airtemp, Div. of Chrysler Corp., Dayton, O.
American Coils, Inc., Newark, N. J.
Baltimore Air Coil Co., Baltimore, Md.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
●Bush Mfg. Co., Hartford, Conn.
Campbell Heating Co., E. K., Kansas City, Mo.
Conditionaire Unit Co., Chicago Ill.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Frigidaire Div., General Motors Corp., Dayton, O.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Griscom-Russell Co., The, New York, N. Y.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
●Kramer Trenton Co., Trenton, N. J.
Larkin Coils, Inc., Atlanta, Ga.
Manufacturers Fin Coil Co., Chicago, Ill.
●Marlo Coil Co., St. Louis, Mo.
●McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
●Murray Mfg. Co., D. J., Wausau, Wis.
●Nesbitt, Inc., John J., Philadelphia, Pa.
Palmer Mfg. Corp., Phoenix, Ariz.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Standard Galvanizing Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Tilco-Fin Inc., Brooklyn, N. Y.
●Trane Co., The, La Crosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
●Wing Mfg. Co., L. J., New York, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 306.

Wolverine Tube Div. of Calumet and Hecla Consolidated Copper Co., Detroit, Mich.
X L Refrigerating Co., Chicago, Ill.
Yates-American Machine Co., Beloit, Wis.
York Ice Machinery Corp., York, Pa.
●**Young Radiator Co., Racine, Wis.**

SURFACE, FINNED, COOLING, DIRECT EXPANSION

●Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●**Aerofin Corp., Syracuse, N. Y.**
Airtemp, Div. of Chrysler Corp., Dayton, O.
American Coils, Inc., Newark, N. J.
Baltimore Air Coil Co., Baltimore, Md.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
●Bush Mfg. Co., Hartford, Conn.
Conditionaire Unit Co., Chicago, Ill.
Drayer & Hanson, Inc., Los Angeles, Cal.
●**Fedders Mfg. Co., Inc., Buffalo, N. Y.**
Frigidaire Div., General Motors Corp., Dayton, O.
●**G. & O. Mfg. Co., New Haven, Conn.**
●**General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.**
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Griscom-Russell Co., The, New York, N. Y.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
●Kramer Trenton Co., Trenton, N. J.
Larkin Coils, Inc., Atlanta, Ga.
Manufacturers Fin Coil Co., Chicago, Ill.
●**Marlo Coil Co., St. Louis, Mo.**
●McCord Radiator & Mfg. Co., Detroit, Mich.
●**McQuay, Inc., Minneapolis, Minn.**
●Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
●**Murray Mfg. Co., D. J., Wausau, Wis.**
Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Standard Galvanizing Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Tilco-Fin Inc., Brooklyn, N. Y.
●Trane Co., The, La Crosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
Wolverine Tube Div. of Calumet and Hecla Consolidated Copper Co., Detroit, Mich.
X L Refrigerating Co., Chicago, Ill.
Yates-American Machine Co., Beloit, Wis.
York Ice Machinery Corp., York, Pa.
●**Young Radiator Co., Racine, Wis.**

SURFACE, FINNED, HEATING, INDIRECT, FERROUS

●**Airtherm Mfg. Co., St. Louis, Mo.**
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Bayley Blower Co., Milwaukee, Wis.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●G. & O. Mfg. Co., New Haven, Conn.
Griscom-Russell Co., The, New York, N. Y.
Kennard, Inc., Sam, St. Louis, Mo.
●Modine Mfg. Co., Racine, Wis.
●**Murray Mfg. Co., D. J., Wausau, Wis.**
●New York Blower Co., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Trane Co., The, LaCrosse, Wis.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
Wolff & Munier, Inc., New York, N. Y. (For panel heating)

SURFACE, FINNED, HEATING, INDIRECT, NON-FERROUS

●**Aerofin Corp., Syracuse, N. Y.**
●**Airtherm Mfg. Co., St. Louis, Mo.**
American Coils, Inc., Newark, N. J.
Bayley Blower Co., Milwaukee, Wis.
Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
●**Bush Mfg. Co., Hartford, Conn.**
Campbell Heating Co., E. K., Kansas City, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
●**Fedders Mfg. Co., Inc., Buffalo, N. Y.**
Frigidaire Div., General Motors Corp., Dayton, O.
●**G. & O. Mfg. Co., New Haven, Conn.**
●**General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.**
Griscom-Russell Co., The, New York, N. Y.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
●Kramer Trenton Co., Trenton, N. J.
Manufacturers Fin Coil Co., Chicago, Ill.
●**Marlo Coil Co., St. Louis, Mo.**
●McCord Radiator & Mfg. Co., Detroit, Mich.
●**McQuay, Inc., Minneapolis, Minn.**
●Modine Mfg. Co., Racine, Wis.
●**Murray Mfg. Co., D. J., Wausau, Wis.**
●**Nesbitt, Inc., John J., Philadelphia, Pa.**
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Tilco-Fin Inc., Brooklyn, N. Y.
●Trane Co., The, La Crosse, Wis.
●**Wing Mfg. Co., L. J., New York, N. Y.**
Wolverine Tube Div. of Calumet and Hecla Consolidated per Co., Detroit, Mich.
Yates-American Machine Co., Beloit, Wis.
York Ice Machinery Corp., York, Pa.
●**Young Radiator Co., Racine, Wis.**

SURFACE THERMOSTATS

See Thermostats, Surface

SWING JOINTS

See Joints, Pipe, Flexible Swing and Revolving

SWITCHES, ELECTRICAL

Adam Electric Co., Frank, St. Louis, Mo.
Allen-Bradley Co., Milwaukee, Wis.
●Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Automatic Switch Co., New York, N. Y.
●**Barber-Colman Co., Rockford, Ill.**
Clark Controller Co., Cleveland, O.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Cooper Co., Clark, Palmyra, N. J.
Cutler-Hammer, Inc., Milwaukee, Wis.
Delta-Star Electric Co., Chicago, Ill.
Dunn, Inc., Struthers, Philadelphia, Pa.
Electric Controller & Mfg. Co., Cleveland, O.
●**General Controls Co., Glendale, Cal.**
●**General Electric Co., Schenectady, N. Y.**
Hart Mfg. Co., Hartford, Conn.
Marsh Corp., Jas. P., Chicago, Ill.
●**McDonnell & Miller, Chicago, Ill.**
●Mercoid Corp., Chicago, Ill.
Micro Switch Corp., Freeport, Ill.
●**Minneapolis-Honeywell Regulator Co., Minneapolis, Minn**
Monitor Controller Co., The, Baltimore, Md.
●Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Square D Co., Detroit, Mich.
Square D Co., Industrial Controller Div., Milwaukee, Wis.
Struthers Dunn, Inc., Philadelphia, Pa.
Tork Clock Co., Inc., Mount Vernon, N. Y.
Trumbull Electric Mfg. Co., Plainville, Conn.
●**Ward Leonard Electric Co., Mount Vernon, N. Y.**
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
White Mfg. Co., St. Paul, Minn.
Zenith Electric Co., Chicago, Ill.

SWITCHES, FLOAT, REFRIGERATION

●**Alco Valve Co., St. Louis, Mo.**
Clark Controller Co., Cleveland, O.
Frick Co., Waynesboro, Pa.
●**McDonnell & Miller, Chicago, Ill.**
●Mercoid Corp., The, Chicago, Ill.
Schaub Engineering Co., Fred H., Chicago, Ill.
●**Ward Leonard Electric Co., Mt. Vernon, N. Y.**

SWITCHES, FLOW

●General Controls Co., Glendale, Cal.
●**McDonnell & Miller, Chicago, Ill.**

SWITCHES, LIQUID LEVEL

Allen-Bradley Co., Milwaukee, Wis.
●Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Automatic Control Co., St. Paul, Minn.
Bender Warrick Corp., Birmingham, Mich.
Bennett Oil Co., Omaha, Neb.

● Advertisement in this issue. See Index to Advertisers, page 306.

Cissell Mfg. Co., W. M., Louisville, Ky.
Cooper Co., Clark, Palmyra, N. J.
Cutler-Hammer, Inc., Milwaukee, Wis.
Detroit Lubricator Co., Detroit, Mich.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
Healy Ruff Co., St. Paul, Minn.
Kisco Boiler & Engineering Co., St. Louis, Mo.
McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
●Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
●Penn Electric Switch Co., Goshen, Ind.
Photoswitch, Inc., Cambridge, Mass.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schaub Engineering Co., Fred H., Chicago, Ill.
Square D Co., Detroit, Mich.
Square D Co., Industrial Controller Div., Milwaukee, Wis.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Trumbull Electric Mfg. Co., Plainville, Conn.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, MERCURY

Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Durakool, Inc., Elkhart, Ind.
General Electric Co., Lamp Dept., Nela Park, Cleveland, O.
Hart Mfg. Co., Hartford, Conn.
Jefferson Electric Co., Bellwood, Ill.
●Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

SWITCHES, PRESSURE AND VACUUM

Allen-Bradley Co., Milwaukee, Wis.
Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Palmyra, N. J.
Cutler-Hammer, Inc., Milwaukee, Wis.
Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
Marsh Corp., Jas. P., Chicago, Ill.
●Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
●Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Sampsel Time Control, Inc., Spring Valley, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Detroit, Mich.
Square D Co., Industrial Controller Div., Milwaukee, Wis.
Uniflow Mfg. Co., Erie, Pa.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●White-Rodgers Electric Co., St. Louis, Mo.

SWITCHES, TIME

Allen-Bradley Co., Milwaukee, Wis.
Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Cooper Co., Clark, Palmyra, N. J.
Cramer Co., Inc., R. W., The, Centerbrook, Conn.
Detroit Lubricator Co., Detroit, Mich.
Edison, Inc., Thomas A., Instrument Div., West Orange, N. J.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
Guardian Electric Mfg. Co., Chicago, Ill.
Industrial Engineering Corp., Terre Haute, Ind.
International Register Co., Chicago, Ill.
●Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Time & Signal Corp., Detroit, Mich.
Paragon Electric Co., Chicago, Ill.
●Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Reliance Automatic Lighting Co., Racine, Wis.
Rhodes, Inc., M. H., Hartford, Conn.
Sampsel Time Control, Inc., Spring Valley, Ill.
Sangamo Electric Co., Springfield, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Tork Clock Co., Inc., Mount Vernon, N. Y.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●White-Rodgers Electric Co., St. Louis, Mo.
Zenith Electric Co., Chicago, Ill.

SYSTEMS, COMBUSTION CONTROL

Askania Regulator Co., Chicago, Ill.
Bailey Meter Co., Cleveland, O.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Engineer Co., New York, N. Y.
Hagan Corp., Pittsburgh, Pa.
●Hays Corp., Michigan City, Ind.
Hotstream Heater Co., Cleveland, O.
●Illinois Engineering Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
●Mercoid Corp., Chicago, Ill.
National Brass Co., Grand Rapids, Mich.
Republic Flow Meters Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Selas Co., The, Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Wheelco Instrument Co., Chicago, Ill.
●Wing Mfg. Co., L. J., New York, N. Y.

SYSTEMS, HEATING, HOT WATER

●Barber-Colman Co., Rockford, Ill.
●Bell & Gossett Co. Morton Grove, Ill.
General Fittings Co., Providence, R. I.
●Hoffman Specialty Co., Indianapolis, Ind.
Kainer & Co., Chicago, Ill.
Kehm Corp., The, Chicago, Ill.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Maid-O'-Mist, Inc., Chicago, Ill.
Penberthy Injector Co., Detroit, Mich.
Sterling, Inc., Milwaukee, Wis.
Sullivan Valve & Engineering Co., Butte, Mont.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
●Trane Co., The, La Crosse, Wis.
Triplex Heating Specialty Co., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.

SYSTEMS, HEATING, VACUUM

All-Vac Steam Control System, Chicago, Ill.
Anderson Products, Inc., Cambridge, Mass.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Cashin, W. D., Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
●Hoffman Specialty Co., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
●Sarco Co., Inc., New York, N. Y.
Sterling, Inc., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
●Trane Co., The, La Crosse, Wis.
●Webster & Co., Warren, Camden, N. J.

SYSTEMS, HEATING, VAPOR

All-Vac Steam Control System, Chicago, Ill.
●American District Steam Co., North Tonawanda, N. Y.
Au-Temp-Co Corp., New York, N. Y.
Barnes & Jones, Inc., Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
●Sarco Co., Inc., New York, N. Y.
Sterling, Inc., Milwaukee, Wis.
●Trane Co., The, La Crosse, Wis.
Vapor Specialty Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

SYSTEMS, HEATING, ZONE CONTROL

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Barnes & Jones, Inc., Boston, Mass.
●Bell & Gossett Co., Morton Grove, Ill.
Cook Electric Co., Chicago, Ill.
●Dunham Co., C. A., Chicago, Ill.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Major Controls Sales Div., Cambridge, Mass.
Marsh Tritrol Co., Chicago, Ill.
●Mercoid Corp., Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 306.

●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Sarco Co., Inc., New York, N. Y.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Spence Engineering Co., Inc., Walden, N. Y.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
Thrush & Co., H. A., Peru, Ind.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.

SYSTEMS, PROCESS HEATING, HIGH TEMPERATURE

All-Vac Steam Control System, Chicago, Ill.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Dow Chemical Co., Midland, Mich.
Foster Wheeler Corp., New York, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Parks-Cramer Co., Fitchburgh, Mass.
Ross Engineering Corp., J. O., New York, N. Y.
Selas Co., The, Philadelphia, Pa.
●Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Trent Co., Harold E., Philadelphia, Pa.
Williams, Inc., F. C., Dearborn, Mich.
●Wing Mfg. Co., L. J., New York, N. Y.

SYSTEMS, ROOF SPRAYING (FOR COOLING ROOFS)

April Showers Co., Washington, D. C.
Rockwood Sprinkler Co., Worcester, Mass.
Ross Sprinkler Co., Pasadena, Cal.
Ruppright, Siegfried, New York, N. Y.
Schubert-Christy Corp., St. Louis, Mo.
●Spraying Systems Co., Chicago, Ill.
Water Cooling Corp., New York, N. Y.

SYSTEMS, SPRINKLER, FOR AIR CONDITIONING DUCT SYSTEMS

Rockwood Sprinkler Co., Worcester, Mass.

TANK HEADS

See Parts, for Heating and Air Conditioning Equipment

TANKS, EXPANSION, FOR HOT WATER HEATING SYSTEMS

●Bell & Gossett Co., Morton Grove, Ill.
Buffalo Tank Co., Dunellen, N. J.
Kopperman & Sons, Joseph, Philadelphia, Pa.
Koven & Bro., Inc., L. O., Jersey City, N. J.
Maysteel Products, Inc., Mayville, Wis.
Stainless & Steel Products Co., St. Paul, Minn.
Thrush & Co., H. A., Peru, Ind.

TANKS, PROCESS AND STORAGE

Aluminum Co. of America, Pittsburgh, Pa.
American Hard Rubber Co., New York, N. Y.
Ames Iron Works, Div. of Pierce Butler Radiator Corp., Oswego, N. Y.
●Bell & Gossett Co., Morton Grove, Ill.
Bigelow Co., New Haven, Conn.
Biggs Boiler Wks. Co., E. Akron, O.
Black-Sivalls & Bryson, Inc., Kansas City, Mo.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
Buffalo Tank Co., Dunellen, N. J.
Caldwell Co., W. E., Louisville, Ky.
Case & Son Mfg. Co., W. A., Buffalo, N. Y.
Chicago Bridge & Iron Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Connery Construction Co., Philadelphia, Pa.
Continental Diamond Fibre Co., Newark, Del.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Dillon Steam Boiler Wks., Inc., D. M., Fitchburg, Mass.
Downingtown Iron Works, Downingtown, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Falstrom Co., Passaic, N. J.
Farquhar Co., Ltd., A. B., York, Pa.
Farrar & Trefts, Buffalo, N. Y.
Frank Heaters, Inc., Paterson, N. J.
Frick Co., Waynesboro, Pa.
Gerstein & Cooper Co., South Boston, Mass.
Goodrich Co., B. F., Akron, O. (Rubber lined)
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
Hamburg Boiler Wks., Inc., Hamburg, Pa.
Harris & Co., Arthur, Chicago, Ill.
Illinois Oil Co., Rock Island, Ill.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Framingham, Mass.
●Kewanee Boiler Corp., Kewanee, Ill.
Kirk & Blum Mfg. Co., Cincinnati, O.
Knight, Maurice A., Akron, O.
Kopperman & Sons, Joseph, Philadelphia, Pa.
Koven & Bro., Inc., L. O., Jersey City, N. J.
La Crosse Tractor Co., La Crosse, Wis.
Lead Lined Iron Pipe Co., Wakefield, Mass.
Littleford Bros., Cincinnati, O.
Manitowoc Boiler Wks., Manitowoc, Wis.
Mauck Seamless Copper Tank Co., Victor, Norristown, Pa.
Maysteel Products, Inc., Mayville, Wis.
Mojonnier Brothers Co., Chicago, Ill.
Murray Iron Wks. Co., Burlington, Ia.
National Lead Co., New York, N. Y.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Quaker City Iron Wks., Philadelphia, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Roessing Mfg. Co., Pittsburgh, Pa.
Rosebraugh Co., W. W., Salem, Ore.
Scaife Co., Oakmont, Pa.
Southbridge Roofing Co., Inc., Southbridge, Mass.
Stainless & Steel Products Co., St. Paul, Minn.
Steinhorst & Sons, Inc., Emil, Utica, N. Y.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Struthers Wells Corp., Titusville, Pa.
Tippett & Wood, Phillipsburg, N. J.
Trageser Copper Wks., Inc., Maspeth, Long Island, N. Y.
Uniflow Mfg. Co., Erie, Pa.
United States Rubber Co., New York, N. Y.
United States Stoneware Co., New York, N. Y.
Vesco Corp., New York, N. Y.
Walsh-Holyoke Steam Boiler Co., Holyoke, Mass.
Waterfilm Boilers, Inc., Jersey City, N. J.
Wheeling Steel Corp., Wheeling, W. Va. (Heater)
●Whitlock Mfg. Co., Hartford, Conn.
Zallea Brothers & Johnson, Wilmington, Del.

TANKS, WASH, FOR CASTINGS

●Bell & Gossett Co., Morton Grove, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.

TEMPERATURE AND HUMIDITY CONTROLS

See Humidistats; Recorder-Controllers; Thermostats

TEMPERATURE RECORDERS

See Recorders, Temperature

TEMPERATURE REGULATORS

See Regulators, Temperature

TESTERS, GAGE, DEAD WEIGHT

Ashton Valve Co., Cambridge, Mass.

THERMOMETERS, INDICATING, INDUSTRIAL

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
American Thermometer Co., St. Louis, Mo.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Martocello & Co., Jos. A., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Philadelphia Thermometer Co., Philadelphia, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
●Powers Regulator Co., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., New York, N. Y.
Pyrometer Instrument Co., New York, N. Y.
Rochester Mfg. Co., Rochester, N. Y.
Scientific Instrument Co., Detroit, Mich.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Tempil Corp., New York, N. Y. (thermometric devices for determination of temperature in industry)

● Advertisement in this issue. See Index to Advertisers, page 306.

Trerice Co., H. O., Detroit, Mich.
●United States Gauge Co., New York, N. Y.
Weksler Thermometer Corp., New York, N. Y.
Weston Electrical Instrument Corp., Newark, N. J.
Wheelco Instruments Co., Chicago, Ill.

THERMOMETERS, INDICATING, REMOTE-READING

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Engelhard, Inc., Charles, Newark, N. J.
Fee & Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●Hays Corp., Michigan City, Ind.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Philadelphia Thermometer Co., Philadelphia, Pa.
●Powers Regulator Co., Chicago, Ill.
Pyrometer Instrument Co., New York, N. Y.
Rochester Mfg. Co., Rochester, N. Y.
●Sarco Co., Inc., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
●United States Gauge Co., New York, N. Y.
Weksler Thermometer Corp., New York, N. Y.
Wheelco Instruments Co., Chicago, Ill.

THERMOMETERS, INDICATING, WALL

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
American Thermometer Co., St. Louis, Mo.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Fee and Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Martocello & Co., Jos. A., Philadelphia, Pa.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Philadelphia Thermometer Co., Philadelphia, Pa.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Pyrometer Instrument Co., New York, N. Y.
Rochester Mfg. Co., Rochester, N. Y.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
●United States Gauge Co., New York, N. Y.
Weksler Thermometer Corp., New York, N. Y. (Effective temperature indicator)
Wheelco Instruments Co., Chicago, Ill.

THERMOMETERS, KATA

G. M. Mfg. Co., New York, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Precision Thermometer & Instrument Co., Philadelphia, Pa.

THERMOSTATIC BELLOWS

See Bellows, Thermostatic

THERMOSTATIC BI-METALS

See Bi-Metals, Thermostatic

THERMOSTATIC TRAPS

See Traps, Steam, Thermostatic

THERMOSTATS, DUCT TYPE

Armstrong Heat Control Co., Portland, Ore.
Atlas Valve Co., Inc., Newark, N. J.
Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Burling Instrument Co., Newark, N. J.
Cook Electric Co., Chicago, Ill.
Detroit Lubricator Co., Detroit, Mich.
Edison, Inc., Thomas A., Instrument Div., West Orange, N. J.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leslie Co., Lyndhurst, N. J.
●Mercoid Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Philadelphia Thermometer Co., Philadelphia, Pa.
●Powers Regulator Co., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
●Sarco Co., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Standard Thermometer, Inc., Boston, Mass.
Superstat Co., Springfield, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
Taylor Instrument Companies, Rochester, N. Y.
United Electric Controls Co., Boston, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Webster Tallmadge & Co., East Orange, N. J.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, EFFECTIVE TEMPERATURE

●Barber-Colman Co., Rockford, Ill.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.

THERMOSTATS, IMMERSION

American Instrument Co., Silver Spring, Md.
Armstrong Heat Control Co., Portland, Ore.
Atlas Valve Co., Inc., Newark, N. J.
Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Burling Instrument Co., Newark, N. J.
Detroit Lubricator Co., Detroit, Mich.
Edison, Inc., Thomas A., Instrument Div., West Orange, N. J.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hart Mfg. Co., Hartford, Conn.
Industrial Engineering Corp., Terre Haute, Ind.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
●Mercoid Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Philadelphia Thermometer Co., Philadelphia, Pa.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
● Powers Regulator Co., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
●Sarco Co., Inc., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Struthers Dunn, Inc., Philadelphia, Pa.
Superstat Co., Springfield, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
United Electric Controls Co., Boston, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Warren Electric Appliance Co., Warren, Pa.
Westinghouse Electric & Mfg. Co., Mansfield, O.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.
Wilcolator Co., Elizabeth, N. J.

THERMOSTATS, ROOM OR WALL

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.

● Advertisement in this issue. See Index to Advertisers, page 306.

Cook Electric Co., Chicago, Ill.
Crise Elec. Mfg. Co., Columbus, O.
Detroit Lubricator Co., Detroit, Mich.
Edison, Inc., Thomas A., Instrument Div., West Orange, N. J.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●Fulton Sylphon Co., Knoxville, Tenn.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
●**Illinois Engineering Co., Chicago, Ill.**
Industrial Engineering Corp., Terre Haute, Ind.
Jefferson Electric Co., Bellwood, Ill.
●**Johnson Service Co., Milwaukee, Wis.**
Magnet Switch Co., Chicago, Ill.
Marsh Tritrol Co., Chicago, Ill.
McCorkle Co., D. H., Berkeley, Calif.
●Mercoid Corp., The, Chicago, Ill.
●**Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.**
●Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
●Powers Regulator Co., Chicago, Ill.
Russell Electric Co., Chicago, Ill.
Sampsel Time Control, Inc., Spring Valley, Ill.
●**Sarco Co., Inc., New York, N. Y.**
Spencer Thermostat Co., Attleboro, Mass.
Standard Thermometer, Inc., Boston, Mass.
Superstat Co., Springfield, Mass.
Tallmadge & Co., Webster, East Orange, N. J.
Thrush & Co., H. A., Peru, Ind.
Triplex Heating Specialty Co., Peru, Ind.
United Electric Controls Co., Boston, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Webster Tallmadge & Co., East Orange, N. J.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, SURFACE

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
● Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Cook Electric Co., Chicago, Ill.
Detroit Lubricator Co., Detroit, Mich.
Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
Hart Mfg. Co., Hartford, Conn.
Industrial Engineering Corp., Terre Haute, Ind.
Jefferson Electric Co., Bellwood, Ill.
McCorkle Co., D. H., Berkeley, Cal.
●Mercoid Corp., The, Chicago, Ill.
●**Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.**
●Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The Dayton, Ohio.
●Powers Regulator Co., Chicago, Ill.
Ranco, Inc., Columbus, O.
●**Sarco Co., Inc., New York, N. Y.**
Spencer Thermostat Co., Attleboro, Mass.
Struthers Dunn, Inc., Philadelphia, Pa.
Superstat Co., Springfield, Mass.
United Electric Controls Co., Boston, Mass.
Westinghouse Electric & Mfg. Co., Mansfield, O.
White Mfg. Co., St. Paul, Minn.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, TWO TEMPERATURE OR DUAL

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Burling Instrument Co., Newark, N. J.
Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●**General Controls Co., Glendale, Cal.**
●**General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.**
Gleason-Avery, Inc., Auburn, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●**Illinois Engineering Co., Chicago, Ill.**
Industrial Engineering Corp., Terre Haute, Ind.
Jefferson Electric Co., Bellwood, Ill.
●**Johnson Service Co., Milwaukee, Wis.**
●Mercoid Corp., The, Chicago, Ill.
●**Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.**
●Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
●Powers Regulator Co., Chicago, Ill.
Ranco, Inc., Columbus, O.
●**Sarco Co., Inc., New York, N. Y.**
Superstat Co., Springfield, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
United Electric Controls Co., Boston, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Webster Tallmadge & Co., East Orange, N. J.
●White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, WEATHER COMPENSATING

Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Detroit Lubricator Co., Detroit, Mich.
●**Illinois Engineering Co., Chicago, Ill.**
●**Johnson Service Co., Milwaukee, Wis.**
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Major Controls Sales Div., Cambridge, Mass.
Marsh Tritrol Co., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.
●**Sarco Co., Inc., New York, N. Y.**
Spencer Thermostat Co., Attleboro, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
Thrush & Co., H. A., Peru, Ind.
United Electric Controls Co., Boston, Mass.
Webster Tallmadge & Co., East Orange, N. J.

TIME SWITCHES

See Switches, Time

TOGGLE BOLTS

See Bolts, Toggle and Anchor

TONGS, PIPE

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Jarecki Mfg. Co., Erie, Pa.
Trimont Mfg. Co., Boston, Mass.
●Williams & Co., J. H., Buffalo, N. Y.

TOOLS (CHISELS, PLIERS, SCREW DRIVERS, ETC.)

Bernz Co., Inc., Otto, Rochester, N. Y.
Billings & Spencer Co., Hartford, Conn.
●Bonney Forge & Tool Works, Allentown, Pa.
Crescent Tool Co., Jamestown, N. Y.
Greene, Tweed & Co., New York, N. Y.
International Nutyp Tool Co., Oswego, N. Y.
Parker-Kalon Corp., New York, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Snap-On Tools Corp., Kenosha, Wis.
Stanley Electric Tool Div., The Stanley Works, New Britain, Conn.

TORCHES, BRAZING AND SOLDERING

Aeroil Burner Co., Inc., West New York, N. J.
●Air Reduction Sales Co., New York, N. Y.
Atkins & Co., E. C., Indianapolis, Ind.
Bernz Co., Inc., Otto, Rochester, N. Y.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Dockson Corp., Detroit, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
Gasweld Equipment Div., Liquid Carbonic Corp., Chicago, Ill.
Harris Calorific Co., The, Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
Insto-Gas Corp., Detroit, Mich.
Johnson Gas Appliance Co., Cedar Rapids, Ia.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Liquid Carbonic Corp., The, Chicago, Ill.
Marquette Mfg. Co., Minneapolis, Minn.
Milburn Co., Alexander, Baltimore, Md.
Minn-Kota Foundry & Mfg. Co., Fargo, N. D.
Modern Engineering Co., St. Louis, Mo.
National Cylinder Gas Co., Chicago, Ill.
National Safety Device Co., Chicago, Ill.
Reiner & Campbell, Inc., Elizabeth, N. J.
Sight Feed Generator Co., Richmond, Ind.
Smith Welding Equipment Corp., Minneapolis, Minn.
Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.
Trindl Products, Ltd., Chicago, Ill.
Welding Apparatus Co., Chicago, Ill.

TORQUE INDICATING WRENCHES

See Wrenches, Torque Indicating

● Advertisement in this issue. See Index to Advertisers, page 306.

TOWERS, COOLING, ATMOSPHERIC

American Cooling Tower Co., Kansas City, Mo.
Binks Mfg. Co., Chicago, Ill.
Burhorn Co., Edwin, New York, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Cal.
Foster Wheeler Corp., New York, N. Y.
Harry Cooling Towers, Inc., New York, N. Y.
●Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
●Marley Co., Kansas City, Kans.
National Engineering & Mfg. Co., Kansas City, Mo.
New England Cooling Tower Co., Boston, Mass.
Pennsylvania Engineering Wks., New Castle, Pa.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Pritchard & Co., J. F., Kansas City, Mo.
Research Corp., New York, N. Y.
Schubert-Christy Corp., Affton, St. Louis, Mo.
Stewart Ice Machine Co., Los Angeles, Cal.
Tippett & Wood, Phillipsburg, N. J.
Water Cooling Corp., New York, N. Y.
Water Cooling Equipment Corp., St. Louis, Mo.
Water Cooling Tower Co., Chicago, Ill.
●Young Radiator Co., Racine, Wis.

TOWERS, COOLING, MECHANICAL DRAFT

American Cooling Tower Co., Kansas City, Mo.
Binks Mfg. Co., Chicago, Ill.
Burhorn Co., Edwin, New York, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Cal.
Foster Wheeler Corp., New York, N. Y.
Harry Cooling Towers, Inc., New York, N. Y.
●Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
●Marley Co., Kansas City, Kans.
National Engineering & Mfg. Co., Kansas City, Mo.
New England Cooling Tower Co., Boston, Mass.
Pennsylvania Engineering Wks., New Castle, Pa.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Pritchard & Co., J. F., Kansas City, Mo.
Research Corp., New York, N. Y.
Schubert-Christy Corp., Affton, St. Louis, Mo.
Water Cooling Corp., New York, N. Y.
Water Cooling Equipment Corp., St. Louis, Mo.
Water Cooling Tower Co., Chicago, Ill.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

TRANSMISSION DRIVES

See Drives, Chain, Flat Belt and V-Belt

TRAPS, STEAM, MECHANICAL

●American District Steam Co., North Tonawanda, N. Y.
●**Anderson Co., V. D., The, Cleveland, O.**
●**Armstrong Machine Wks., Three Rivers, Mich.**
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Bishop & Babcock Mfg. Co., Cleveland, O.
Boylston Steam Specialty Co., Chicago, Ill.
Bundy Steam Trap Co., Nashua, N. H.
Burrows Mfg. Co., F. A., York, Pa.
Cashin Co., W. D., Boston, Mass.
Cochrane Corp., Philadelphia, Pa.
Coe Mfg. Co., Painesville, O.
●Crane Co., Chicago, Ill.
Cryer Trap & Valve Co., Inc., New York, N. Y.
Davis Engineering Corp., Elizabeth, N. J.
Davis Regulator Co., Chicago, Ill.
●**Dunham Co., C. A., Chicago, Ill.**
Ellis Drier Co., Chicago, Ill.
●**Fisher Governor Co., Marshalltown, Ia.**
●**Haines & Co., William S., Philadelphia, Pa.**
Healy Ruff Co., St. Paul, Minn.
●Hoffman Specialty Co., Indianapolis, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●**Illinois Engineering Co., Chicago, Ill.**
Johnson Corp., Three Rivers, Mich.
Justus Steam Trap Co., Napanoch, N. Y.
Kaye & MacDonald, Inc., West Orange, N. J.
Keckley Co., O. C., Chicago, Ill.
●Kieley & Mueller, Inc., North Bergen, N. J.
Klipfel Mfg. Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
McAuley Trap Co., Pittsburgh, Pa.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Morehead Mfg. Co., Detroit, Mich.
Mouat Vapor Heating Co., The, Cleveland, O.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Nason Co., Detroit, Mich.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
●**Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.**
●**Sarco Co., Inc., New York, N. Y.**
Schaub Engineering Co., Fred H., Chicago, Ill.
Squires Co., C. E., Cleveland, O.
Sterling, Inc., Milwaukee, Wis.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Templeton Bros., Boston, Mass. (Return)
Templeton Mfg. Co., Hyde Park, Mass.
●Trane Co., The, LaCrosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Vapor Specialty Co., New York, N. Y.
Watson & McDaniel Co., Philadelphia, Pa.
●**Webster & Co., Warren, Camden, N. J.**
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.
●**Yarnall-Waring Co., Philadelphia, Pa.**

TRAPS, STEAM, THERMOSTATIC

All-Vac Steam Control System, Chicago, Ill.
●**American District Steam Co., North Tonawanda, N. Y**
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Bishop & Babcock Mfg. Co., Cleveland, O.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Cashin Co., W. D., Boston, Mass.
●**Clifford Mfg. Co., Boston, Mass.**
Cryer Trap & Valve Co., Inc., New York, N. Y.
●**Dunham Co., C. A., Chicago, Ill.**
●**Haines & Co., William S., Philadelphia, Pa.**
●Hoffman Specialty Co., Indianapolis, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa
●**Illinois Engineering Co., Chicago, Ill.**
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
●**Powers Regulator Co., Chicago, Ill.**
●**Sarco Co., Inc., New York, N. Y.**
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling, Inc., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Trane Co., The, LaCrosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vapor Specialty Co., New York, N. Y.
●**Webster & Co., Warren, Camden, N. J**

TREATMENT, STEAM SYSTEM, TO INHIBIT CORROSION

Anderson-Stolz Corp., Kansas City, Mo.
●Cannon Chemical Co., Everett, Mass.
Haering Co., Inc., D. W. Chicago, Ill.
Rid-Sludge, Inc., Minneapolis, Minn. (vapor treatment to remove sludge from heating system)
Western Chemical Co., Kansas City, Mo.

TREATMENT, WATER, TO INHIBIT CORROSION

Activator Process Sales Co., Alhambra, Cal.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American K. A. T. Corp., New York, N. Y.
American Water Softener Co., Philadelphia, Pa.
American Well Works, Aurora, Ill.
Anderson-Stolz Corp., Kansas City, Mo.
Aquatic Chemical Laboratories, Inc., New York, N. Y.
Automatic Pump & Softener Corp., Rockford, Ill.
Calgon, Inc., Pittsburgh, Pa.
●Cannon Chemical Co., Everett, Mass.
Cochrane Corp., Philadelphia, Pa.
Continental Products Co., Euclid, O.
Dampney Co. of America, Boston, Mass.
Dearborn Chemical Co., Chicago, Ill.
Electroaire Corp., Chicago, Ill.
Elgin Softener Corp., Elgin, Ill.
Ferro-Nil Corp., New York, N. Y.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
Grief, Edward C., Bogota, N. J.
Haering Co., D. W., Chicago, Ill.
Hagan Corp., Pittsburgh, Pa.
Maintenance Engineering Corp., Houston, Tex.
Metropolitan Refining Co., Long Island City, N. Y.
Monsanto Chemical Co., Organic Chemicals Div., St. Louis, Mo.
Mutual Chemical Co. of America, New York, N. Y.
National Aluminate Corp., Chicago, Ill.
North American Fibre Products Co., The, Cleveland, O.
Norwood Filtration Co., The, Florence, Mass.
Oakite Products, Inc., New York, N. Y.
% Proportioneers, Inc., %, Providence, R. I.
Permutit Co., New York, N. Y.,
R. U. V. Engineering Corp., New York, N. Y.
Red Jacket Mfg. Co., Davenport, Ia.
Refinite Corp., Omaha, Nebr.
●**Research Products Corp., Madison, Wis.**
Solvay Sales Corp, New York, N. Y.
Sudbury Laboratory, South Sudbury, Mass.

● Advertisement in this issue. See Index to Advertisers, page 306.

Uniflow Mfg. Co., Erie, Pa.
Vinco Co., Inc., The, New York, N. Y.
Wallace & Tiernan Co., Inc., Belleville, N. J.
Warlo Corp., New York, N. Y.
Water Refining Co., Ft. Wayne, Ind.
Water Service Laboratories, Inc., New York, N. Y.
Western Chemical Co., Kansas City, Mo.
●Worthington Pump & Machinery Corp., Harrison, N. J.

TUBE CLEANERS

See Cleaners, Tube

TUBES, BOILER

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co., New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
Globe Steel Tubes Co., Milwaukee, Wis.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keeney Mfg. Co., Newington, Conn.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Oil City Tank and Boiler Co., Oil City, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Steel & Tubes, Div. of Republic Steel Corp., Cleveland, O.
Timken Roller Bearing Co., Steel & Tube Div., Canton, O.

TUBES, PITOT

Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
Hill, E. Vernon, Chicago, Ill.
Meriam Co., The, Cleveland, O.

TUBING, ALUMINUM

Aluminum Co. of America, Pittsburgh, Pa.
Brasco Mfg. Co., Harvey, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Revere Copper and Brass Incorporated, New York, N. Y.
Wolverine Tube Div. of Calumet and Hecla Consolidated Copper Co., Detroit, Mich.

TUBING BENDERS

See Benders, Tubing

TUBING, BRASS AND COPPER

●**American Brass Co., Waterbury, Conn.**
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Conklin Brass & Copper Co., Inc., T. E., New York, N. Y.
Downs-Smith Brass & Copper Co., New York, N. Y.
●**Hussey & Co., C. G., Pittsburgh, Pa.**
Imperial Brass Mfg. Co., Chicago, Ill.
Lewin-Mathes Co., Lewin Metals Div., St. Louis, Mo.
●**Mueller Brass Co., Port Huron, Mich.**
Packless Metal Products Corp., New Rochelle, N. Y.
Parker Appliance Co., Cleveland, O.
Phelps Dodge Copper Products Corp., British American Tube Div., New York, N. Y.
Revere Copper and Brass, Incorporated, New York, N. Y.
Roberts Tube Works, Detroit, Mich.
Wolverine Tube Div. of Calumet and Hecla Consolidated Copper Co., Detroit, Mich.

TUBING CUTTERS

See Cutters, Tubing

TUBING, FINNED

●**Aerofin Corp., Syracuse, N. Y.**
Brown Fintube Co., The, Elyria, O.
●**Bush Mfg. Co., Hartford, Conn.**
Chase Brass & Copper Co., Waterbury, Conn.
●**G. & O. Mfg. Co., New Haven, Conn.**
Industrial Mfg. & Engineering Co., Chicago, Ill.
●Kramer Trenton Co., Trenton, N. J.
Manufacturers Fin Coil Co., Chicago, Ill.
●**McCord Radiator & Mfg. Co., Detroit, Mich.**
●**McQuay, Inc., Minneapolis, Minn.**
Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Tilco-Fin, Inc., Brooklyn, N. Y.
Vapor Car Heating Co., Inc., Chicago, Ill.
Wolverine Tube Div. of Calumet and Hecla Consolidated Copper Co., Detroit, Mich. (Aluminum, copper)

TUBING, NICKEL AND NICKEL ALLOY

Chase Brass & Copper Co., Waterbury, Conn.
General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Globe Steel Tubes Co., Milwaukee, Wis.
●**International Nickel Co., New York, N. Y.**
Pittsburgh Steel Co., Pittsburgh, Pa.
Revere Copper and Brass, Incorporated, New York, N. Y.
●Western Cartridge Co., Brass Mill Div., East Alton, Ill.

TUBING, PLASTIC

Acadia Synthetic Products Div., Western Felt Works, Chicago, Ill.
Celanese Celluloid Corp., New York, N. Y.
Colonial Alloys Co., Metals Div., Philadelphia, Pa.
Dow Chemical Co., Midland, Mich.
Extruded Plastics, Inc., Norwalk, Conn.
General Electric Co., Plastics Div., Pittsfield, Mass.
Hodgman Rubber Co., Framingham, Mass.
Imperial Brass Mfg. Co., Chicago, Ill.
Mills Corp., Elmer E., Chicago, Ill.
North Penn Co., New York, N. Y.
Resistoflex Corp., Belleville, N. J.
Skuttle Mfg. Co., Detroit, Mich.
United States Stoneware Co., New York, N. Y.
Werner Co., Inc., R. D., New York, N. Y.

TUBING, SILVER CLAD AND SILVER ALLOY

General Plate Div., Metals & Controls Corp., Attleboro, Mass.

TUBING, STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Brasco Mfg. Co., Harvey, Ill.
Bundy Tubing Co., Detroit, Mich.
Detroit Seamless Steel Tubes Co., Detroit, Mich.
Everhot Products Co., Chicago, Ill.
Globe Steel Tubes Co., Milwaukee, Wis.
Imperial Brass Mfg. Co., Chicago, Ill.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Oil City Tank and Boiler Co., Oil City, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Pittsburgh Tube Co., Pittsburgh, Pa.
Revere Copper and Brass, Incorporated, New York, N. Y.
South Chester Tube Co., Chester, Pa.
●**Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.**
Standard Tube Co., Highland Park, Mich.
Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.
Timken Roller Bearing Co., Steel & Tube Div., Canton, O.
Wheatland Tube Co., Philadelphia, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
●**Youngstown Sheet & Tube Co., Youngstown, O.**

TUBING, STEEL, STAINLESS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Alloy Steel Products Co., Linden, N. J.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Brasco Mfg. Co., Harvey, Ill.
Carpenter Steel Co., The, Welded Alloy Tube Div., Kenilworth, N. J.
Chicago Metal Hose Corp., Maywood, Ill. (flexible)
Colonial Alloys Co., Metals Div., Philadelphia, Pa.
Duraloy Co., Scottdale, Pa.
Globe Steel Tubes Co., Milwaukee, Wis.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.
Timken Roller Bearing Co., Steel & Tube Div., Canton, O.

TURBINES, MECHANICAL DRIVE

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Carling Blower Co., Worcester, Mass.
Coppus Engineering Corp., Worcester, Mass.
Dean Hill Pump Co., Anderson, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Elliott Co., Jeannette, Pa.

● Advertisement in this issue. See Index to Advertisers, page 306.

●General Electric Co., Schenectady, N. Y.
Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.
Murray Iron Wks. Co., Burlington, Ia.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Terry Steam Turbine Co., Hartford, Conn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wing Mfg. Co., L. J., New York, N. Y.

2, 3 AND 4-WAY VALVES

See Valves, 2, 3 and 4-way

UNDERGROUND PIPING

See Conduit, Underground Piping

UNIONS, BRASS

Acheson Mfg. Co., Rankin, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Chase Brass & Copper Co., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
●Flori Pipe Co., The, St. Louis, Mo.
General Fittings Co., Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
Hays Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., The, Elmira, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
Lunkenheimer Co., Cincinnati, O.
● Mueller Brass Co., Port Huron, Mich.
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Powell Co., Wm., Cincinnati, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Union Metal Works, Inc., Chelsea, Mass.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburg, Pa.
Williams Valve Co., D. T., Cincinnati, O.

UNIONS, MALLEABLE, BRASS SEAT

Corley Co., Jersey City, N. J.
●Crane Co., Chicago, Ill.
Dart Mfg. Co., E. M., Providence, R. I.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devlin Mfg. Co., Inc., Thos, Burlington, N. J.
●Fairbanks Co., New York, N. Y.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
●Flori Pipe Co., The, St. Louis, Mo.
General Fittings Co., Providence R. I.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jefferson Union Co., Lexington, Mass.
Jefferson Union Co., Inc., Lockport, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
Malleable Iron Fittings Co., Branford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Rockwood Sprinkler Co., Worcester, Mass.
Standard Union Co., Lockport, N. Y.
Star Mfg. Co., Inc., Providence, R. I.
Stockham Pipe Fittings Co., Birmingham, Ala.
United Superior Union Co., Inc., Brooklyn, N. Y.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburg, Pa.

UNIONS, STEEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Catawissa Valve & Fittings Co., Catawissa, Pa.
Champion Machine & Forging Co., Cleveland, O.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
●Crane Co., Chicago, Ill.
●Flori Pipe Co., The, St. Louis, Mo.
Frick Co., Waynesboro, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis.
Rockwood Sprinkler Co., Worcester, Mass.
Roessing Mfg. Co., Pittsburgh, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.

UNIT COOLERS

See Coolers, Unit

UNIT HEATERS

See Heaters, Unit

UNIT VENTILATORS

See Ventilators, Unit

UNITS, AIR CONDITIONING, CENTRAL STATION TYPE

Self contained blower, heating and/or cooling coil, filter, humidifier unit for remote location and duct air distribution

●Air & Refrigeration Corp., New York, N. Y.
Airtemp, Div. of Chrysler Corp., Dayton, O.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Corp., Detroit, Mich.
American Cooling Tower Co., Kansas City, Mo.
Anetsberger Bros., Chicago, Ill.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Beacon-Morris Corp., Boston, Mass. (Custom built)
Betz Air Conditioning Corp., Kansas City, Mo.
Betz Corp., Hammond, Ind.
Bryant Heater Co., The, Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Coroaire Heater Corp., The, Cleveland, O.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Forman Air Conditioning & Engrg. Co., New York, N. Y.
Frigidaire Div., General Motors Corp., Dayton, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Governair Corp., Oklahoma City, Okla.
Hastings Air Conditioning Co., Hastings, Neb.
Howe Ice Machine Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
●Kramer Trenton Co., Trenton, N. J.
●Marlo Coil Co., St. Louis, Mo.
McLouth Air Conditioning Corp., Lansing, Mich.
●McQuay, Inc., Minneapolis, Minn.
Micheli Air Conditioning Co., Inc., Schenectady, N. Y.
●Modine Mfg. Co., Racine, Wis.
Niagara Blower Co., New York, N. Y.
Palmer's Mfg. Corp., Phoenix, Ariz.
Pernot & Rich, Inc., Los Angeles, Cal.
Refrigeration Economics Co., Inc., Canton, O.
Scott-Newcomb, Inc., St. Louis, Mo.
●Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Stainless & Steel Products Co., St. Paul, Minn.
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Surface Combustion, Toledo, O.
●Trane Co., The, La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
United States Radiator Corp., Detroit, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
●Worthington Pump & Machinery Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, HORIZONTAL PACKAGE TYPE

Self contained blower, cooling and/or heating coil, filter, humidifier unit for ceiling or platform location in space condition, for connection to remote compressor or cold water supply, and steam or hot water

Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Beacon-Morris Corp., Boston, Mass. (Custom built)
Betz Corp., Hammond, Ind.
●Buffalo Forge Co., Buffalo, N. Y.
Carrier Corp., Syracuse, N. Y.
Champion Unit Heater Co., Chicago, Ill.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
Coroaire Heater Corp., The, Cleveland, O.

● Advertisement in this issue. See Index to Advertisers, page 306.

●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Frigidaire Div., General Motors Corp., Dayton, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Hastings Air Conditioning Co., Hastings, Neb.
Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
●Kramer Trenton Co., Trenton, N. J.
●Marlo Coil Co., St. Louis, Mo.
Mayflower Air-Conditioners, Inc., St. Paul, Minn.
McLouth Air Conditioning Corp., Lansing, Mich.
●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
Niagara Blower Co., New York, N. Y.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
●Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Stainless & Steel Products Co., St. Paul, Minn.
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
Sturtevant Co., B. F., Boston, Mass.
●Trane Co., The, La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
United States Radiator Corp., Detroit, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
Western Blower Co., Seattle, Wash.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
●Worthington Pump & Machinery Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, INDUSTRIAL TYPE

●Air & Refrigeration Corp., New York, N. Y.
American Blower Corp., Detroit, Mich.
American Cooling Tower Co., Kansas City, Mo.
Anetsberger Bros., Chicago, Ill.
Bahnson Co., Winston-Salem, N. C.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Beacon-Morris Corp., Boston, Mass. (Custom built)
Betz Air Conditioning Corp., Kansas City, Mo.
Bryant Heater Co., The, Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Economy Equipment Co., Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.
●General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Howe Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
International Moistening Co., Providence, R. I.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
●Kramer Trenton Co., Trenton, N. J.
Lintern Co., Berea, O.
●Marlo Coil Co., St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
Niagara Blower Co., New York, N. Y.
Norwood Filtration Co., The, Florence, Mass.
Parks-Cramer Co., Fitchburg, Mass.
Pfening Co., Fred D., Columbus, O.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Research Corp., New York, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
●Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Somers, Inc., H. J., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Surface Combustion, Toledo, O.
Tenney Engineering, Inc., Bloomfield, N. J.
●Trane Co., The, La Crosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
●Worthington Pump & Machinery Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, SUMMER, EVAPORATIVE COOLING TYPE

For cooling with sprays, no dehumidification

●Air & Refrigeration Corp., New York, N. Y.
Air-O-Line Co., The, Dallas, Tex.
American Blower Corp., Detroit, Mich.
American Cooling Tower Co., Kansas City, Mo.
American Metal Products Co., Fort Worth, Tex.
April Showers Co., Washington, D. C.
Aqua-Mist Co., Topeka, Kans.
Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal
Ballantyne Co., Omaha, Nebr.
Beacon-Morris Corp., Boston, Mass.
Bien Air Conditioning Co., Bell, Cal.
Campbell Heating Co., E. K., Kansas City, Mo.
Carrier Corp., Syracuse, N. Y.
Conco Corp., Div. of H. D. Conkey & Co., Mendota, Ill.
Dallas Engineering Co., Inc., Dallas, Tex.
Economy Electric Mfg. Co., Chicago, Ill.
Electrogas Furnace Co., San Francisco, Cal.
Essick Mfg. Co., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
Great National Air Conditioning Corp., Dallas, Tex.
Hall Mfg. Co., Cedar Rapids, Ia.
Montag Stove & Furnace Works, Portland, Ore.
Mountain States Equipment Co., Denver, Col.
National Engineering & Mfg. Co., Kansas City, Mo.
Norman Sheet Metal Mfg. Co., W. F., Nevada, Mo.
Northwest Stove & Furnace Wks., Inc., Portland, Ore.
Pacific Airmax Corp., Huntington Park, Cal.
Palmer's Mfg. Corp., Phoenix, Ariz.
Pernot & Rich, Inc., Los Angeles, Cal.
Royal Air Conditioning Equipment Co., Alhambra, Cal.
Shreveport Engineering Co., Inc., Shreveport, La.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Western Blower Co., Seattle, Wash.
X L Refrigerating Co., Chicago, Ill.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, SUMMER, ROOM TYPE FLOOR CABINET, REMOTE COMPRESSOR OR COLD WATER, UNDER 3 TONS CAPACITY

Self contained blower, coil, filter unit for connection to remote compressor or cold water supply

Airgard Mfg. Co., Chicago, Ill.
Airtemp, Div. of Chrysler Corp., Dayton, O.
Carrier Corp., Syracuse, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
General Air Conditioning Corp., Cincinnati, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
Giant Mfg. Co., Council Bluffs, Ia.
Hall Mfg. Co., Cedar Rapids, Ia.
Hastings Air Conditioning Co., Hastings, Neb.
Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo
Kennard, Inc., Sam, St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
McLouth Air Conditioning Corp., Lansing, Mich.
●McQuay, Inc., Minneapolis, Minn.
Norwin Co., Freeport, Ill.
Peerless of America, Inc., Chicago, Ill.
Perham Products, Inc., Chicago, Ill.
Premier Furnace Co., Dowagiac, Mich.
Refrigeration Economics Co., Inc., Canton, O.
Scott-Newcomb, Inc., St. Louis, Mo.
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
●Trane Co., The, La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Unified Air Conditioner Co., Duluth, Minn.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, SUMMER, ROOM TYPE FLOOR CABINET, SELF CONTAINED COMPRESSOR, UNDER 3 HP

Self contained blower, coil, compressor, filter unit

Airtemp, Div. of Chrysler Corp., Dayton, O.
Carrier Corp., Syracuse, N. Y.
Coroaire Heater Corp., The, Cleveland, O.
Fairbanks, Morse & Co., Chicago, Ill.
Gale Products, Galesburg, Ill.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.

● Advertisement in this issue. See Index to Advertisers, page 306.

Harvey-Whipple, Inc., Springfield, Mass.
Ice Cooling Appliance Corp., Morrison, Ill. (Ice)
Ilg Electric Ventilating Co., Chicago, Ill.
Indian Trailer Corp., Koolroom Div., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Meyer Furnace Co., Peoria, Ill.
Peerless of America, Inc., Chicago, Ill.
Philco Corp., Philadelphia, Pa.
Pleasantaire Corp., Washington, D. C.
Premier Furnace Co., Dowagiac, Mich.
Scott-Newcomb, Inc., St. Louis, Mo.
●Trane Co., The, La Crosse, Wis.
●Worthington Pump & Machinery Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.
York Ice Machinery Corp., York, Pa.

UNITS, AIR CONDITIONING, SUMMER, STORE TYPE, FLOOR CABINET, SELF CONTAINED COMPRESSOR, 3 HP AND OVER

Self contained blower, coil, compressor, filter unit with air discharge approximately 6 ft above floor

Airtemp, Div., of Chrysler Corp., Dayton, O.
●Buffalo Forge Co., Buffalo, N. Y.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
Forman Air Conditioning & Engrg. Co., New York, N. Y.
Frick Co., Waynesboro, Pa.
Frigidaire Div., General Motors Corp., Dayton, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Nevinger Mfg. Co., Inc., Greenville, Ill.
Niagara Blower Co., New York, N. Y.
Peerless of America, Inc., Chicago, Ill.
Scott-Newcomb, Inc., St. Louis, Mo.
●Trane Co., The, La Crosse, Wis.
Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., Springfield, Mass.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
●Worthington Pump & Machinery Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.

UNITS, AIR CONDITIONING, WINTER, ROOM TYPE, FLOOR CABINET

Self contained blower, filter, heating coil, humidifier unit

●Air & Refrigeration Corp., New York, N. Y.
●Burnham Boiler Corp., Irvington, N. Y.
Campbell Heating Co., Des Moines, Ia.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Drayer & Hanson, Inc., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
Northwest Stove & Furnace Wks., Inc., Portland, Ore.
Pan-American Engineering Co., Berkeley, Cal.
Peerless of America, Inc., Chicago, Ill.
Perham Products, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
●Reznor Mfg. Co., Mercer, Pa.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Somers, Inc., H. J., Detroit, Mich.
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
Surface Combustion, Toledo, O.
●Trane Co., The, La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Unified Air Conditioner Co., Duluth, Minn.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, YEAR AROUND, ROOM TYPE, FLOOR CABINET

Self contained blower, cooling and heating coil, filter, humidifier unit for connection to remote compressor or cold water supply, and steam or hot water supply

●Air & Refrigeration Corp., New York, N. Y.
Airtemp, Div. of Chrysler Corp., Dayton, O.
Beacon-Morris Corp., Boston Mass. (Custom built)
Betz Air Conditioning Corp., Kansas City, Mo.
Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Coroaire Heater Corp., The, Cleveland, O.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
●Grinnell Co., Inc., Providence, R. I.
Hastings Air Conditioning Co., Hastings, Neb.
Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Kennard, Inc., Sam, St. Louis, Mo.
●Kramer Trenton Co., Trenton, N. J.
●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, Moline, Ill.
Peerless of America, Inc., Chicago, Ill.
Perham Products, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Semco Mfg. Co., Nashville, Tenn.
Standard Computing Scale Co., The, Air Conditioning and Refrigeration Div., Detroit, Mich.
●Trane Co., The, La Crosse, Wis.
Unified Air Conditioner Co., Duluth, Minn.
●Worthington Pump & Machinery Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, WINDOW VENTILATOR AND FILTER

Airgard Mfg. Co., Chicago, Ill.
American Air Conditioning Co., Detroit, Mich.
Automatic Ventilator Co., Corunna, Mich.
Berger Mfg. Div., Republic Steel Corp., Canton, O.
Davies Air Filter Corp., New York, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Gale Products, Galesburg, Ill.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Ilg Electric Ventilating Co., Chicago, Ill.
Kaiser Co., H. S., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Mellish & Murray Co., Chicago, Ill.
National Engineering & Mfg. Co., Kansas City, Mo.
Reed Unit-Fans, Inc., New Orleans, La.
Reliable Sheet Metal Engineering Co., Chicago, Ill
Somers, Inc., H. J., Detroit, Mich.
Unified Air Conditioner Co., Duluth, Minn.
Utility Fan Corp., Los Angeles, Cal.
Vita-Screen Ventilator Co., New York, N. Y.

UNIVERSAL JOINTS

See Joints, Universal, for Operating Valves

VACUUM GAGES

See Gages, Indicating, Vacuum

VACUUM HEATING SYSTEMS

See Systems, Heating, Vacuum

VACUUM PUMPS

See Pumps, Vacuum

VACUUM RECORDERS

See Recorders, Pressure and Vacuum

VALVE OPERATORS

See Operators, Valve

VALVE RESEATERS

See Reseaters, Valve

VALVES, ANGLE

Albright Equipment Co., Johnstown, Pa.
Alloy Steel Products Co., Linden, N. J. (Stainless steel)
●American Brass Co., Waterbury, Conn.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.

● Advertisement in this issue. See Index to Advertisers, page 306.

Bordo Co., Inc., L. J., Glenside, Pa. (Plug)
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Brass Mfg. Co., Cleveland, O.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Chase Brass & Copper Co., Waterbury, Conn.
Cochrane Corp., Philadelphia, Pa.
●Crane Co., Chicago, Illl.
Detroit Brass & Malleable Wks., Detroit, Mich.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Gorton Heating Corp., Cranford, N. J.
●Grinnell Co., Inc., Providence, R. I.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Milwaukee Valve Co., Milwaukee, Wis.
●Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Stockham Pipe Fittings Co., Birmingham, Ala.
Strong, Carlisle & Hammond Co., Cleveland, O.
Walworth Co., New York, N. Y.
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, BALANCING, RADIATOR, FOR FORCED HOT WATER HEATING SYSTEMS

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Bell & Gossett Co., Morton Grove, Ill.
Detroit Lubricator Co., Detroit, Mich.
Hammond Brass Works, Hammond, Ind.
Marsh Valve Co., Dunkirk, N. Y.

VALVES, BLOW-OFF

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Babcock & Wilcox Co., New York, N. Y.
Barrett Machine Co., N. S. Pittsburgh, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Clees Valve & Engineering Co., New York, N. Y.
Cochrane Corp., Philadelphia, Pa.
●Crane Co., Chicago, Illl.
Eclipse Fuel Engineering Co., Rockford, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Elliott Co., Jeannette, Pa.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Keckley Co., O. C., Chicago. Ill.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Norgren Co., C. A., Denver, Colo.
Ohio Injector Co., Wadsworth, O.
Parker Appliance Co., Cleveland, O.
Permutit Co., New York, N. Y.
Powell Co., Wm., Cincinnati, O.
Strong, Carlisle & Hammond Co., Cleveland, O.
Walworth Co., New York, N. Y.
●Yarnall-Waring Co., Philadelphia, Pa.

VALVES, CHECK

Albright Equipment Co., Johnstown, Pa.
Alloy Steel Products Co., Linden, N. J. (Stainless steel)
American Hard Rubber Co., New York, N. Y. (Hard rubber)
Barrett, Haentjens & Co., Hazleton, Pa.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Catawissa Valve & Fittings Co., Catawissa, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Chase Brass & Copper Co., Waterbury, Conn.
Cochrane Corp., Philadelphia, Pa.
Cooper Co., Clark, Palmyra, N. J.
●Crane Co., Chicago, Illl.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
●Flori Pipe Co., The, St. Louis, Mo.
Foster Engineering Co., Newark, N. J.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
●Grinnell Co., Inc., Providence, R. I.
Hammond Brass Works, Hammond, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Locke Regulator Co., Salem, Mass.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Co., Decatur, Ill.
●Mueller Brass Co., Port Huron, Mich.
Norgren Co., C. A., Denver, Colo.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
Preferred Utilities Mfg. Corp., New York, N. Y.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rensselaer Valve Co., Cohoes, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass. (Bleeder type)
Schutte & Koerting Co., Philadelphia, Pa.
Smolensky Valve Co., Inc., Cleveland, O.
Sterling, Inc., Milwaukee, Wis.
Stockham Pipe Fittings Co., Birmingham, Ala.
Stokes Rubber Co., Jos., Trenton, N. J. (Hard rubber)
Strong, Carlisle & Hammond Co., Cleveland, O.
Taco Heaters, Inc., New York, N. Y.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J. (Hydraulic service)
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Gauge Co., Pittsburgh, Pa. (Noiseless)
Williams Valve Co., D. T., Cincinnati, O.

VALVES, DIAPHRAGM

American Hard Rubber Co., New York, N. Y. (Rubber lined)
American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Atlas Valve Co., Inc., Newark, N. J.
Belfield Co., H., Philadelphia, Pa.
Black-Sivalls & Bryson, Inc., Kansas City, Mo.
Boylston Steam Specialty Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
●Cash Co., A. W., Decatur, Ill.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Palmyra, N. J.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Eclipse Fuel Engineering Co., Rockford, Ill.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●General Controls Co., Glendale, Cal.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Hagan Corp., Pittsburgh, Pa.
●Henry Valve Co., Chicago, Ill.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Kainer & Co., Chicago, Ill.
●Kieley & Mueller, Inc., North Bergen, N. J.
Klipfel Mfg. Co., Chicago, Ill.
Kunkle Valve Co., Ft. Wayne, Ind.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Mueller Brass Co., Port Huron, Mich.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Norgren Co., C. A., Denver, Colo.
Northern Indiana Brass Co., Elkhart, Ind.
Parks-Cramer Co., Fitchburg, Mass.

● Advertisement in this issue. See Index to Advertisers, page 306.

Powell Co., Wm., Cincinnati, O.
•Powers Regulator Co., Chicago, Ill.
•Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
•Trane Co., The, La Crosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Triplex Heating Specialty Co., Peru, Ind.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
•White-Rodgers Electric Co., St. Louis, Mo.

VALVES, FIRE PROTECTION, SPRINKLER SYSTEM CONTROL

•Barber-Colman Co., Rockford, Ill.
Everlasting Valve Co., Jersey City, N. J.
•Hodgman Mfg. Co., Taunton, Mass.
Raisler Corp., Grimes Sprinkler Div., New York, N. Y.
Rockwood Sprinkler Co., Worcester, Mass.
Ross Sprinkler Co., Pasadena, Cal.

VALVES, FLOAT

Albright Equipment Co., Johnstown, Pa.
•Alco Valve Co., St. Louis, Mo.
American Hard Rubber Co., New York, N. Y. (Hard rubber)
Atlas Valve Co., Inc., Newark, N. J.
•Automatic Products Co., Milwaukee, Wis. (Oil)
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Caldwell Co., W. E., Louisville, Ky.
•Cash Co., A. W., Decatur, Ill.
Central Brass Mfg. Co., Cleveland, O.
Cochrane Corp., Philadelphia, Pa.
Cooper Co., Clark, Palmyra, N. J.
•Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
•Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
•Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
•Kieley & Mueller, Inc., North Bergen, N. J.
Klipfel Mfg. Co., Chicago, Ill.
Locke Regulator Co., Salem, Mass.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Maid-O'-Mist, Inc., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
•McDonnell & Miller, Chicago, Ill.
Monash-Younker Co., Chicago, Ill.
Monmouth Products Co., Cleveland, O.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Phillips & Co., H. A., Chicago, Ill.
•Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schaub Engineering Co., Fred H., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Stickle Steam Specialties Co., Indianapolis, Ind.
Swartwout Co., Cleveland, O.
•Trane Co., The, La Crosse, Wis.
Viking Air Conditioning Corp., Cleveland, O.
Voss Co., J. H. H., New York, N. Y.
Watts Regulator Co., Lawrence, Mass.

VALVES, FLOW CONTROL, FOR HOT WATER HEATING SYSTEMS

•Bell & Gossett Co., Morton Grove, Ill.
•Illinois Engineering Co., Chicago, Ill.
Kainer & Co., Chicago, Ill.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
•Trane Co., The, La Crosse, Wis.

VALVES, FORGED STEEL

Albright Equipment Co., Johnstown, Pa.
Catawissa Valve & Fittings Co., Catawissa, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Clees Valve & Engineering Co., New York, N. Y.
Cochrane Corp., Philadelphia, Pa.
•Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Everlasting Valve Co., Jersey City, N. J.
•Flori Pipe Co., The, St. Louis, Mo.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
•Henry Valve Co., Chicago, Ill.
Parker Appliance Co., Cleveland, O.
Schutte & Koerting Co., Philadelphia, Pa.
Steel Improvement & Forge Co., Cleveland, O.
Strong, Carlisle & Hammond Co., Cleveland, O.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
•Watson-Stillman Co., Roselle, N. J.

VALVES, GATE, BRASS AND BRONZE

•American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
Belknap Mfg. Co., Bridgeport, Conn.
Bordo Co., Inc., L. J., Glenside, Pa.
Capitol Brass Works, Div. of Bohn Aluminum Brass Corp., Detroit, Mich.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Chase Brass & Copper Co., Waterbury, Conn.
•Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
Eddy Valve Co., Waterford, N. Y.
Everlasting Valve Co., Jersey City, N. J.
•Fairbanks Co., New York, N. Y.
•Flori Pipe Co., The, St. Louis, Mo.
Hammond Brass Wks., Hammond, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
•Hoffman Specialty Co., Indianapolis, Ind.
Jarecki Mfg. Co., Erie, Pa.
•Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Milwaukee Valve Co., Milwaukee, Wis.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Cincinnati, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
•R-S Products Corp., Philadelphia, Pa.
•Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rensselaer Valve Co., Cohoes, N. Y.
Scott Valve Mfg. Co., Detroit, Mich.
Stockham Pipe Fittings Co., Birmingham, Ala.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GATE, IRON BODY

Bordo Co., Inc., L. J., Glenside, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
•Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
Everlasting Valve Co., Jersey City, N. J.
•Fairbanks Co., New York, N. Y.
•Flori Pipe Co., The, St. Louis, Mo.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
•Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Valve & Fittings Co., Barberton, O.
Powell Co., Wm., Cincinnati, O.
•R-S Products Corp., Philadelphia, Pa.
•Reading-Pratt & Cady Div., American Chain & Cable Co., Inc. Reading, Pa.
Rensselaer Valve Co., Cohoes, N. Y.
Scott Valve Mfg. Co., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

• Advertisement in this issue. See Index to Advertisers, page 306.

VALVES, GATE, STEEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
American Hard Rubber Co., New York, N. Y.
Bordo Co., Inc., L. J., Glenside, Pa.
Central Brass Mfg. Co., Cleveland, O.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (stainless)
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Everlasting Valve Co., Jersey City, N. J.
●Flori Pipe Co., The, St. Louis, Mo.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
●**Jenkins Bros., New York, N. Y.**
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Ohio Injector Co., Wadsworth, O.
Powell Co., Wm., Cincinnati, O.
●R-S Products Corp., Philadelphia, Pa.
●**Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.**
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.

VALVES, GLOBE, BRASS AND BRONZE

●American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Chase Brass & Copper Co., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
●**Fairbanks Co., New York, N. Y.**
●Flori Pipe Co., The, St. Louis, Mo.
●**Grinnell Co., Inc., Providence, R. I.**
Hammond Brass Wks., Hammond, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Hoffman Specialty Co., Indianapolis, Ind.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●**Jenkins Bros., New York, N. Y.**
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Milwaukee Valve Co., Milwaukee, Wis.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Cincinnati, O.
Ostlind Valve, Inc., Portland, Ore.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●**Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.**
Scott Valve Mfg. Co., Detroit, Mich.
Stockham Pipe Fittings Co., Birmingham, Ala.
Strong, Carlisle & Hammond Co., Cleveland, O.
Walworth Co., New York, N. Y.
●**Watson-Stillman Co., Roselle, N. Y. (Hydraulic service)**
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GLOBE, IRON BODY

Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Belfield Co., H., Philadelphia, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Cyrus Shank Co., Chicago, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●**Fairbanks Co., New York, N. Y.**
●Flori Pipe Co., The, St. Louis, Mo.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Jarecki Mfg. Co., Erie, Pa.
●**Jenkins Bros., New York, N. Y.**
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●**Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.**
Scott Valve Mfg. Co., Detroit, Mich.
Shank Co., Cyrus, Chicago, Ill.
Strong, Carlisle & Hammond Co., Cleveland, O.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GLOBE, STEEL

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
Automatic Temperature Control Co., Inc., Philadelphia, Pa
Belfield Co., H., Philadelphia, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Clees Valve & Engineering Co., New York, N. Y.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (stainless)
●Crane Co., Chicago, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Flori Pipe Co., The, St. Louis, Mo.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Jarecki Mfg. Co., Erie, Pa.
●**Jenkins Bros., New York, N. Y.**
Klingerit, Inc., New York, N. Y.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Ostlind Valve, Inc., Portland, Ore.
Parker Appliance Co., Cleveland, O.
Powell Co., Wm., Cincinnati, O.
●**Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.**
Schutte & Koerting Co., Philadelphia, Pa.
Streng, Carlisle & Hammond Co., Cleveland, O.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.

VALVES, LINED

American Hard Rubber Co., New York, N. Y. (Hard rubber lined)
●American Smelting & Refining Co., New York, N. Y.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass
Goodrich Co., B. F., Akron, O. (Rubber lined)
Hasco Valve & Machine Co., Milwaukee, Wis. (Rubber)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead or tin)
National Lead Co., New York, N. Y. (Lead)
Northern Indiana Brass Co., Elkhart, Ind. (Tinned)
Resisto Pipe & Valve Co., East Cambridge, Mass. (Lead)
Schutte & Koerting Co., Philadelphia, Pa. (Lead)

VALVES, MIXING, HOT AND COLD WATER

●Fulton Sylphon Co., Knoxville, Tenn.
General Fittings Co., Providence, R. I.
Klipfel Mfg. Co., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Sarco Co., Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.

VALVES, MIXING, STEAM AND WATER

●Bell & Gossett Co., Morton Grove, Ill.
Boiler Room Equipment, Inc., New York, N. Y.
Central Brass Mfg. Co., Cleveland, O.
Cooper Co., Clark, Palmyra, N. J.
Dole Valve Co., The, Chicago, Ill.
●Fulton Sylphon Co., Knoxville, Tenn.
General Fittings Co., Providence, R. I.
●Johnson Service Co., Milwaukee, Wis.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Leonard Valve Co., Providence, R. I.
●Powers Regulator Co., Chicago, Ill.
●**Sarco Co., Inc., New York, N. Y.**
Schutte & Koerting Co., Philadelphia, Pa.
Sterling, Inc., Milwaukee, Wis.
Thermo-Mix, Inc., Long Island City, N. Y. (Thermostatic mixing valve for hot and cold water)
Vapor Car Heating Co., Inc., Chicago, Ill.

VALVES, MOTOR OPERATED

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●**Barber-Colman Co., Rockford, Ill.**
●Bell & Gossett Co., Morton Grove, Ill.
Bristol Co., Waterbury, Conn.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Cochrane Corp., Philadelphia, Pa.
Cooper Co., Clark, Palmyra, N. J.
●Crane Co., Chicago, Ill.
Cutler-Hammer, Inc., Milwaukee, Wis.
Darling Valve & Mfg. Co., Williamsport, Pa.
Davis Regulator Co., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●**Fairbanks Co., New York, N. Y.**
Foxboro Co., Foxboro, Mass.
●**General Controls Co., Glendale, Cal.**

● Advertisement in this issue. See Index to Advertisers, page 306.

●General Electric Co., Schenectady, N. Y.
Hanlon-Waters, Inc., Tulsa, Okla.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
●Illinois Engineering Co., Chicago, Ill.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
●Kieley & Mueller, Inc., North Bergen, N. J.
Leslie Co., Lyndhurst, N. J.
Ludlow Valve Mfg. Co., Inc., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Mason-Neilan Regulator Co., Boston, Mass.
●Mercoid Corp., Chicago, Ill.
Merco-Nordstrom Valve Co., Pittsburgh, Pa.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Permutit Co., New York, N. Y.
Philadelphia Gear Works, Inc., Philadelphia, Pa.
Powell Co., Wm., Cincinnati, O.
Preferred Utilities Mfg. Corp., New York, N. Y.
●R-S Products Corp., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.

VALVES, NEEDLE

Alloy Steel Products Co., Linden, N. J. (Stainless steel)
●Automatic Products Co., Milwaukee, Wis. (oil)
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Cyrus Shank Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
Detroit Lubricator Co., Detroit, Mich.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Flori Pipe Co., The, St. Louis, Mo.
Grove Regulator Co., Oakland, Cal.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hanlon-Waters, Inc., Tulsa, Okla.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
Maid-O'-Mist, Inc., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Norgren Co., C. A., Denver, Colo.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Parker Appliance Co., Cleveland, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co. Inc., Reading, Pa.
Schaub Engineering Co., Fred H., Chicago, Ill.
Shank Co., Cyrus, Chicago, Ill.
Taylor Instrument Companies, Rochester, N. Y.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J. (Hydraulic service)
Williams Valve Co., D. T., Cincinnati, O.

VALVES, PLASTIC

Haveg Corp., Newark, Del.

VALVES, PLUG

American Car & Foundry Co., New York, N. Y.
Barrett, Haentjens & Co., Hazleton, Pa.
Barrett Machine Co., N. S., Pittsburgh, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Duriron Co., Inc., Dayton, O. (acid resisting)
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Inner-Tite Clamp Corp., Elizabeth, N. J.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., The, Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Merco Nordstrom Valve Co., Pittsburgh, Pa. (Lubricated)
Mueller Co., Decatur, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Brass Mfg. Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Stockham Pipe Fittings Co., Birmingham, Ala.
Taylor Instrument Companies, Rochester, N. Y.
Walworth Co., New York, N. Y.
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, PRESSURE REDUCING AND REGULATING, AIR AND GAS

Atlas Valve Co., Inc., Newark, N. J.
●Barber-Colman Co., Rockford, Ill.
Belfield Co., H., Philadelphia, Pa.
Black-Sivalls & Bryson, Inc., Kansas City, Mo.
Boylston Steam Specialty Co., Chicago, Ill.
●Cash Co., A. W., Decatur, Ill.
Central Brass Mfg. Co., Cleveland, O.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Clees Valve & Engineering Co., New York, N. Y.
Cooper Co., Clark, Palmyra, N. J.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Eclipse Fuel Engineering Co., Rockford, Ill.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
●Fulton Sylphon Co., Knoxville, Tenn.
●General Controls Co., Glendale, Cal.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Grove Regulator Co., Oakland, Cal.
Hagan Corp., Pittsburgh, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
Hubbell Corp., Chicago, Ill.
●Illinois Engineering Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.
●Kieley & Mueller, Inc., North Bergen, N. J.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Modern Engineering Co., St. Louis, Mo.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Norgren Co., C. A., Denver, Colo.
Northern Equipment Co., Erie, Pa.
Pacific Airmax Corp., Huntington Park, Cal.
●Powers Regulator Co., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Roberts-Gordon Appliance Corp., Buffalo, N. Y.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., Cleveland, O.
Sullivan Valve & Engineering Co., Butte, Mont.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
Trerice Co., H. O., Detroit, Mich.
Triplex Heating Specialty Co., Peru, Ind.
Tryco Products, Inc., Westfield, Mass.
Voss Co., J. H. H., New York, N. Y.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
Webster Tallmadge & Co., East Orange, N. J.
White Flo-Matic Corp., Hoosick Falls, N. Y.

VALVES, PRESSURE REDUCING AND REGULATING, HOT WATER

●Bell & Gossett Co., Morton Grove, Ill.
●Cash Co., A. W., Decatur, Ill.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
●Crane Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Hanlon-Waters, Inc., Tulsa, Okla.
●Illinois Engineering Co., Chicago, Ill.
Kainer & Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 306.

●Kieley & Mueller, Inc., North Bergen, N. J.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Republic Flow Meters Co., Chicago, Ill.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
Trerice Co., H. O., Detroit, Mich.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

VALVES, PRESSURE REDUCING AND REGULATING, STEAM

All-Vac Steam Control System, Chicago, Ill.
●American District Steam Co., North Tonawanda, N. Y.
Atlas Valve Co., Inc., Newark, N. J.
Bailey Meter Co., Cleveland, O.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
●Cash Co., A. W., Decatur, Ill.
Central Brass Mfg. Co., Cleveland, O.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Clees Valve & Engineering Co., New York, N. Y.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
●Dunham Co., C. A., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
●Fulton Sylphon Co., The, Knoxville, Tenn.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Grove Regulator Co., Oakland, Cal.
Hagan Corp., Pittsburgh, Pa.
Hanlon-Waters, Inc., Tulsa, Okla.
Hubbell Corp., Chicago, Ill.
●Illinois Engineering Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.
●Kieley & Mueller, Inc., North Bergen, N. J.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Northern Equipment Co., Erie, Pa.
●Powers Regulator Co., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Republic Flow Meters Co., Chicago, Ill.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Triplex Heating Specialty Co., Peru, Ind.
Vapor Car Heating Co., Inc., Chicago, Ill.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
Webster Tallmadge & Co., East Orange, N. J.
White Flo-Matic Corp., Hoosick Falls, N. Y.

VALVES, RADIATOR, AIR

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Anderson Products, Inc., Cambridge, Mass.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
●Burnham Boiler Corp., Irvington, N. Y.
Chicago Specialty Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Detroit Lubricator Co., Detroit, Mich.
Dole Valve Co., The, Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Indianapolis, Ind.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Keeney Mfg. Co., Newington, Conn.
●Little Mfg. Co., M. S., Hartford, Conn.
Maid-O'-Mist, Inc., Chicago, Ill. (Humidifying)
Marsh Corp., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Metal Products Corp., Chicago, Ill.
New York Air Valve Corp., New York, N. Y.
Russell & Co., W. A., Bridgeport, Conn.
Slater Mfg. Co., Wakefield, Mass.
Sullivan Valve & Engineering Co., Butte, Mont.
●Trane Co., The, LaCrosse, Wis.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, ELECTRIC

Au-Temp-Co Corp., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Electric Valve Mfg. Co., Inc., New York, N. Y.
●Fulton Sylphon Co., Knoxville, Tenn.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Vapor Car Heating Co., Inc., Chicago, Ill.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, PNEUMATIC

American Schaeffer & Budenburg Instrument Div., Manning Maxwell & Moore, Inc., Bridgeport, Conn.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, SELF-CONTAINED

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
American Schaeffer & Budenburg Instrument Div., Manning Maxwell & Moore, Inc., Bridgeport, Conn.
Au-Temp-Co Corp., New York, N. Y.
Clees Valve & Engineering Co., New York, N. Y.
Edison, Inc., Thos. A., Instrument Div., West Orange, N. J.
●Fulton Sylphon Co., Knoxville, Tenn.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Powers Regulator Co., Chicago, Ill.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
●Trane Co., The, LaCrosse, Wis.
Webster Tallmadge & Co., East Orange, N. J.

VALVES, RADIATOR, ORIFICE

●American District Steam Co., North Tonawanda, N. Y.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Au-Temp-Co Corp., New York, N. Y.
Barnes & Jones, Inc., Boston, Mass.
●Bell & Gossett Co., Morton Grove, Ill.
Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
●Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
New York Air Valve Corp., New York, N. Y.
●Sarco Co., Inc., New York, N. Y.
●Trane Co., The, LaCrosse, Wis.
●Webster & Co., Warren, Camden, N. J.

VALVES, RADIATOR, STEAM AND HOT WATER, HAND

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Bishop & Babcock Mfg. Co., Cleveland, O.
●Burnham Boiler Corp., Irvington, N. Y.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Chase Brass & Copper Co., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Fairbanks Co., New York, N. Y.
Gorton Heating Corp., Cranford, N. J.
●Grinnell Co., Inc., Providence, R. I.
●Haines & Co., William S., Philadelphia, Pa.
Hammond Brass Wks., Hammond, Ind.
●Hoffman Specialty Co., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
Marsh Corp., Jas. P., Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 306.

Marsh Valve Co., Dunkirk, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Powell Co., Wm., Cincinnati, O.
●Sarco Co., Inc., New York, N. Y.
Scott Valve Mfg. Co., Detroit, Mich.
Sterling, Inc., Milwaukee, Wis.
●Trane Co., The, LaCrosse, Wis.
Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, RADIATOR, STEAM AND HOT WATER, MODULATING

●American District Steam Co., North Tonawanda, N. Y.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Barnes & Jones, Inc., Boston, Mass.
Belknap Mfg. Co., Bridgeport, Conn.
Bishop & Babcock Mfg. Co., Cleveland, O.
Cashin Co., W. D., Boston, Mass.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Cryer Trap & Valve Co., Inc., New York, N. Y.
Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corp., Cranford, N. J.
●Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Indianapolis, Ind.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
McAlear Mfg. Co., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Mouat Vapor Heating Co., The, Cleveland, O.
Ohio Brass Co., Mansfield, O.
Pierce Butler Radiator Corp., Syracuse, N. Y.
●Sarco Co., Inc., New York, N. Y.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co.. Webster, East Orange, N. J.
●Trane Co., The, LaCrosse, Wis.
Vapor Specialty Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.

VALVES, REFRIGERATION (ANGLE, CHECK, GATE, GLOBE, NEEDLE, RELIEF)

Ashton Valve Co., Cambridge, Mass.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Black-Sivalls & Bryson, Inc., Kansas City, Mo.
Central Brass Mfg. Co., Cleveland, O.
●Crane Co., Chicago, Ill.
Cyrus Shank Co., Chicago, Ill.
●Detroit Stamping Co., Detroit, Mich.
●Flori Pipe Co., The, St. Louis, Mo.
Frick Co., Waynesboro, Pa.
●Henry Valve Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
●Jenkins Bros., New York, N. Y.
Kerotest Mfg. Co., Pittsburgh, Pa.
Lunkenheimer Co., Cincinnati, O.
●Mueller Brass Co., Port Huron, Mich.
Peerless of America, Inc., Chicago, Ill.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Reynolds Mfg. Co., Inc., Springfield, Mo.
Shank Co., Cyrus, Chicago, Ill.
Superior Valve and Fittings Co., Pittsburgh, Pa.
Triumph Ice Machine Co., Cincinnati, O.
Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
Weatherhead Co., Cleveland, O.
●Worthington Pump & Machinery Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, BACK PRESSURE

●Alco Valve Co., St. Louis, Mo.
Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
Electrimatic Div., The, of the Simoniz Co., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Frigidaire Div., General Motors Corp., Dayton, O.
Hubbell Corp., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
●Mueller Brass Co., Port Huron, Mich.
Temprite Products Corp., Detroit, Mich.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, EXPANSION, CONSTANT PRESSURE

●Alco Valve Co., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
●Baker Ice Machine Co., Inc., Omaha, Neb.
●Cash Co., A. W., Decatur, Ill.
Consolidated Safety Valve Div., Manning, Maxwell & Moore Inc., Bridgeport, Conn.
Detroit Lubricator Co., Detroit, Mich.
Foster Engineering Co., Newark, N. J.
Frigidaire Div., General Motors Corp., Dayton, O.
Hubbell Corp., Chicago, Ill.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
Peerless of America, Inc., Chicago, Ill.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, EXPANSION, THERMOSTATIC

●Alco Valve Co., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
Detroit Lubricator Co., Detroit, Mich.
Frigidaire Div., General Motors Corp., Dayton, O.
●General Controls Co., Glendale, Cal.
Larkin Coils, Inc., Atlanta, Ga.
Mayson Mfg. Co., Inc., Detroit, Mich.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
Peerless of America, Inc., Chicago, Ill.
Spoehrer-Lange Co., St. Louis, Mo.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, FLOAT, HIGH PRESSURE

●Alco Valve Co., St. Louis, Mo.
American Injector Co., Detroit, Mich.
Foster Engineering Co., Newark, N. J.
Frick Co., Waynesboro, Pa.
Hubbell Corp., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
●Mercoid Corp., Chicago, Ill.
Phillips & Co., H. A., Chicago, Ill.
Schaub Engineering Co., Fred H., Chicago, Ill.
Strong, Carlisle & Hammond Co., Cleveland, O.
Temprite Products Corp., Detroit, Mich.
Vilter Mfg. Co., Milwaukee, Wis.
Voss Co., J. H. H., New York, N. Y.
Weatherhead Co., Cleveland, O.
●Worthington Pump & Machinery Corp., Air Conditioning and Refrigeration Div., Harrison, N. J.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, MAGNETIC STOP

●Alco Valve Co., St. Louis, Mo.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
Detroit Lubricator Co., Detroit, Mich.
Electric Valve Mfg. Co., Inc., New York, N. Y.
Electrimatic Div., The, of the Simoniz Co., Chicago, Ill.
Frick Co., Waynesboro, Pa.
●General Controls Co., Glendale, Cal.
Hubbell Corp., Chicago, Ill.
●Mercoid Corp., Chicago, Ill.
●Penn Electric Switch Co., Goshen, Ind.

VALVES, REFRIGERATION, WATER REGULATING, PRESSURE OR TEMPERATURE ACTUATED

American Injector Co., Detroit, Mich.
Art Valve Co., Chicago, Ill.
●Automatic Products Co., Milwaukee, Wis.
●Cash Co., A. W., Decatur, Ill.
Cyrus Shank Co., Chicago, Ill.
Electrimatic Div., The, of the Simoniz Co., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Frigidaire Div., General Motors Corp., Dayton, O.
●Mercoid Corp., Chicago, Ill.
Mueller Co., Decatur, Ill.
●Penn Electric Switch Co., Goshen, Ind.
Perfection Refrigeration Parts Co., Harvey, Ill.
Phillips & Co., H. A., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Shank Co., Cyrus, Chicago, Ill.
Spence Engineering Co., Inc., Walden, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 306.

VALVES, RELIEF, HOT WATER, COMBINED PRESSURE AND TEMPERATURE OPERATED

Beaton & Cadwell Mfg. Co., New Britain, Conn.
Carpenter & Paterson, Inc., East Boston, Mass.
●Crane Co., Chicago, Ill.
Kainer & Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Thrush & Co., H. A., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.

VALVES, RELIEF, HOT WATER, PRESSURE OPERATED

Ashton Valve Co., Cambridge, Mass.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
●Bell & Gossett Co., Morton Grove, Ill.
Black-Sivalls & Bryson, Inc., Kansas City, Mo.
Boylston Steam Specialty Co., Chicago, Ill.
Carpenter & Paterson, Inc., East Boston, Mass.
●Cash Co., A. W., Decatur, Ill.
Consolidated Safety Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fisher Governor Co., Marshalltown, Ia.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Kainer & Co., Chicago, Ill.
●Kieley & Mueller, Inc., North Bergen, N. J.
Klipfel Mfg. Co., Chicago, Ill.
Kunkle Valve Co., Ft. Wayne, Ind.
Locke Regulator Co., Salem, Mass.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
Maid-O'-Mist, Inc., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Parker Appliance Co., The, Cleveland, O.
Penberthy Injector Co., Detroit, Mich.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spencer Thermostat Co., Attleboro, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Swartwout Co., Cleveland, O.
Taco Heaters, Inc., New York, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Heating Specialty Co., Peru, Ind.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

VALVES, RELIEF, HOT WATER, PRESSURE OPERATED, SELF-FILLING

Beaton & Cadwell Mfg. Co., New Britain, Conn.
●Bell & Gossett Co., Morton Grove, Ill.
●Crane Co., Chicago, Ill.
●Kieley & Mueller, Inc., North Bergen, N. J.
Mueller Co., Decatur, Ill.
Thrush & Co., H. A., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.

VALVES, SADDLE

Imperial Brass Mfg. Co., Chicago, Ill.
Maid-O'-Mist, Inc., Chicago, Ill.
Walworth Co., New York, N. Y.

VALVES, SAFETY, STEAM

Ashton Valve Co., Cambridge, Mass.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Consolidated Safety Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Foster Engineering Co., Newark, N. J.
●Kieley & Mueller, Inc., North Bergen, N. J.
Kunkle Valve Co., Ft. Wayne, Ind.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
●McDonnell & Miller, Chicago, Ill.
Scott Valve Mfg. Co., Detroit, Mich.
Walworth Co., New York, N. Y.

VALVES, SOLDER JOINT

●American Brass Co., Waterbury, Conn.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Chase Brass & Copper Co., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Hammond Brass Works, Hammond, Ind.
●Jenkins Bros., New York, N. Y.
●Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
Scott Valve Mfg. Co., Detroit, Mich.
Walworth Co., New York, N. Y. (Brazed)
Weatherhead Co., Cleveland, O.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, SOLENOID

Albright Equipment Co., Johnstown, Pa.
●Alco Valve Co., St. Louis, Mo.
Anderson Products, Inc., Cambridge, Mass.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Belfield Co., H., Philadelphia, Pa.
Cooper Co., Clark, Palmyra, N. J.
Cutler-Hammer, Inc., Milwaukee, Wis.
Davis Regulator Co., Chicago, Ill.
Detroit Lubricator Co., Detroit, Mich.
Electric Valve Mfg. Co., Inc., New York, N. Y.
Electrimatic Div., The, of the Simoniz Co., Chicago, Ill.
Frick Co., Waynesboro, Pa.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
General Sales & Products Co., Cohoes, N. Y.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Guardian Electric Mfg. Co., Chicago, Ill.
Hubbell Corp., Chicago, Ill.
Hunt & Son, C. B., Salem, O.
●McDonnell & Miller, Chicago, Ill.
●Mercoid Corp., Chicago, Ill.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
●Penn Electric Switch Co., Goshen, Ind.
Pfening Co., Fred D., Columbus, O.
●R-S Products Corp., Philadelphia, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
Spoehrer-Lange Co., St. Louis, Mo.
Square D Co., Detroit, Mich.
Supreme Electric Products Corp., Rochester, N. Y.
Vapor Car Heating Co., Inc., Chicago, Ill.
Wheelco Instruments Co., Chicago, Ill.
●White-Rodgers Electric Co., St. Louis, Mo.

VALVES, 2, 3, AND 4 WAY

Albright Equipment Co., Johnstown, Pa.
●Alco Valve Co., St. Louis, Mo.
●American Brass Co., Waterbury, Conn.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
●Barber-Colman Co., Rockford, Ill.
Belfield Co., H., Philadelphia, Pa.
Bordo Co., Inc., Glenside, Pa.
Bristol Co., Waterbury, Conn.
●Cash Co., A. W., Decatur, Ill.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
Detroit Lubricator Co., Detroit, Mich.
●General Controls Co., Glendale, Cal.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Hunt & Son, C. B., Salem, O.
Imperial Brass Mfg. Co., Chicago, Ill.
Inland Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Johnson Service Co., Milwaukee, Wis.
Kerotest Mfg. Co., Pittsburgh, Pa.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
●Mercoid Corp., Chicago, Ill.
Merco-Nordstrom Valve Co., Pittsburgh, Pa.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Min
●Mueller Brass Co., Port Huron, Mich.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Parker Appliance Co., Cleveland, O.

● Advertisement in this issue. See Index to Advertisers, page 306.

●Penn Electric Switch Co., Goshen, Ind.
Powell Co., Wm., Cincinnati, O.
●Powers Regulator Co., Chicago, Ill.
●R-S Products Corp., Philadelphia, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Philadelphia, Pa.
Spence Engineering Co., Inc., Walden, N. Y.
Strong, Carlisle & Hammond Co., Cleveland, O.
Taylor Instrument Companies, Rochester, N. Y.
Walworth Co., New York, N. Y. (Lubricated plug valves)
●Watson-Stillman Co., Roselle, N. J. (Hydraulic service)
Weatherhead Co., Cleveland, O.
Williams Valve Co., D. T., Cincinnati, O.

VANES, DUCT TURNING, PREFABRICATED

Air Devices, Inc., New York, N. Y.
●Barber-Colman Co., Rockford, Ill.
Stewart Mfg. Co., Orange, N. J. (Outlet scoops)
●Tuttle & Bailey, Inc., New Britain, Conn.
Waterloo Register Co., Waterloo, Ia.

VAPOR HEATING SYSTEMS

See Systems, Heating, Vapor

VARIABLE SPEED PULLEYS

See Changers, Speed, Mechanical

V-BELT DRIVES

See Drives, V-Belt

VELOCITY REGULATORS

See Regulators, Air Velocity

VENETIAN BLINDS

See Blinds, Venetian

VENTILATION HEATERS

See Surface, Finned, Heating

VENTILATORS, MUSHROOM

Aeolus Dickinson, Chicago, Ill.
Best Register Co., Milwaukee, Wis.
Industrial Sheet Metal Works, Inc., Detroit, Mich.
Knowles Mushroom Ventilator Co., Montclair, N. J.
Mueller Furnace Co., L. J., Milwaukee, Wis.
●Tuttle & Bailey, Inc., New Britain, Conn.
Ventilating Products Co., Chicago, Ill.

VENTILATORS, ROOF, FAN

Aeolus Dickinson, Chicago, Ill.
Air Controls, Inc., Cleveland, O.
Airmaster Corp., Chicago, Ill.
Allen Corp., Detroit, Mich.
American Blower Corp., Detroit, Mich.
American Coolair Corp., Jacksonville, Fla.
American-Larson Ventilating Co., Pittsburgh, Pa.
American Steel Band Co., Pittsburgh, Pa.
Arex Co., Chicago, Ill.
Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.
Belanger Fan & Blower Co., Detroit, Mich.
Burt Mfg. Co., Akron, O.
Century Fan & Ventilator Co., New York, N. Y.
Chelsea Fan & Blower Co., Irvington, N. J.
Clay Equipment Corp., Cedar Falls, Ia.
Davidson Hy Duty Roof Fan Co., Newton, Mass.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Diehl Mfg. Co., Elizabethport, N. J.
Dual Air Fan Co., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Empire Ventilation Equipment Co., Long Island City, N. Y.
Fingles, Inc., W. A., Baltimore, Md.
Gallaher Co., The, Owatonna, Minn.
Goethel Co., Alfred C., Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Corp., Grand Rapids, Mich.
Hirschman Co., W. F., Buffalo, N. Y.
Howes-Woods Co., Cambridge, Mass.
Ilg Electric Ventilating Co., Chicago, Ill.
Industrial Sheet Metal Works, Inc., Detroit, Mich.
International Engineering, Inc., Dayton, O.
Iona Ventilator Co., Inc., Philadelphia, Pa.
Johnson Fan & Blower Corp., Chicago, Ill.
Jordan & Co., Paul R., Indianapolis, Ind.
Kernchen Co., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Klauer Mfg. Co., Dubuque, Ia.
Lohman Co., Wm. J., Irvington, N. J.
Mellish & Murray Co., Chicago, Ill.
Myers Electric Co., Inc., Pittsburgh, Pa.
●New York Blower Co., Chicago, Ill.
Penn Ventilating Co., Philadelphia, Pa.
Phoenix Ventilator Co., Inc., Brooklyn, N. Y.
Propellair, Inc., Springfield, O.
Reed Unit-Fans, Inc., New Orleans, La.
Robertson Co., H. H., Pittsburgh, Pa.
Royal Ventilator Co., Philadelphia, Pa.
Schwitzer-Cummins Co., Indianapolis, Ind.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Swartwout Co., Cleveland, O.
Trade-Wind Motorfans, Inc., Los Angeles, Cal.
●Trane Co., The, La Crosse, Wis.
Truflo Fan Co., Harmony, Pa.
Uno Ventilator Co., Cliftondale, Mass.
Utility Fan Corp., Los Angeles, Cal.
Van Noorden Co., E., Boston, Mass.
Viking Air Conditioning Corp., Cleveland, O.
Washburne & Co., E. G., New York, N. Y.
Waverly Heating Supply Co., Boston, Mass.
Western Engineering & Mfg. Co., Los Angeles, Cal.
●Wing Mfg. Co., L. J., New York, N. Y.
●Young Radiator Co., Racine, Wis.

VENTILATORS, ROOF, GRAVITY

Accurate Mfg. Works, Chicago, Ill.
Aeolus Dickinson, Chicago, Ill.
Air Control Products, Inc., Coopersville, Mich.
●Airtherm Mfg. Co., St. Louis, Mo.
Allen Corp., Detroit, Mich.
American-Larson Ventilating Co., Pittsburgh, Pa.
American Metal Products Co., Fort Worth, Texas.
American Sheet Metal Works, New Orleans, La.
American Steel Band Co., Pittsburgh, Pa.
Ames Co., W. R., San Francisco, Cal.
Arex Co., Chicago, Ill.
Autoforce Ventilating System, Boston, Mass.
Berger Bros. Co., Philadelphia, Pa.
Breidert Co., G. C., Los Angeles, Cal.
Burt Mfg. Co., Akron, O.
Century Fan & Ventilating Co., New York, N. Y.
Chicago Metal Mfg. Co., Chicago, Ill.
Cincinnati Sheet Metal & Roofing Co., Cincinnati, O.
Clay Equipment Corp., Cedar Falls, Ia.
Day Co., The, Minneapolis, Minn.
Edwards Mfg. Co., Inc., Cincinnati, O.
Empire Ventilation Equipment Co., Long Island City, N. Y.
Fingles, Inc., W. A., Baltimore, Md.
Goethel Co., Alfred C., Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Hirschmann Co., W. F., Buffalo, N. Y.
Howes-Woods Co., Cambridge, Mass.
Industrial Sheet Metal Works, Inc., Detroit, Mich.
International Steel Co., Evansville, Ind.
Iona Ventilator Co., Inc., Philadelphia, Pa.
Iwan Brothers, South Bend, Ind.
Jamar Co., Walker, Duluth, Minn.
Jordan & Co., Paul R., Indianapolis, Ind.
Kernchen Co., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Klauer Mfg. Co., Dubuque, Ia.
Kleenaire Corp., Stevens Point, Wis.
La Crosse Steel Roofing & Corrugating Co., La Crosse, Wis.
Lamneck Products, Inc., Middletown, O.
Lee & Son Co., Thomas, Cincinnati, O.
Leslie Welding Co., Chicago, Ill.
Levow, David, New York, N. Y.
Martin Metal Mfg. Co., Wichita, Kans.
Mellish & Murray Co., Chicago, Ill.
Merchant & Evans Co., Philadelphia, Pa.
Milcor Steel Co., Milwaukee, Wis.
Norman Sheet Metal Mfg. Co., W. F., Nevada, Mo.
Osborn Co., The, J. M. & L. A., Cleveland, O.
Patten Co., J. V., Sycamore, Ill.
Penn Ventilating Co., Philadelphia, Pa.
Phoenix Ventilator Co., Inc., Brooklyn, N. Y.
Pioneer Roofing & Sheet Metal Co., Muskogee, Okla.
Puhl & Hepper Mfg. Co., Inc., St. Louis, Mo.
Riggin Metal Products, Inc., Kankakee, Ill.
Robertson Co., H. H., Pittsburgh, Pa.
Royal Ventilator Co., Philadelphia, Pa.
Rynicker Sheet Metal Works, Inc., Billings, Mont.
St. Paul Corrugating Co., St. Paul, Minn.
Schoedinger, F. O., Columbus, O.
Sheet Metal Mfg. Co., Inc., Brooklyn, N. Y.
Southbridge Roofing Co., Inc., Southbridge, Mass.
Southern States Iron Roofing Co., Savannah, Ga.
Steinhorst & Sons, Inc., Emil, Utica, N. Y.
Swartwout Co., Cleveland, O.
Tierney Rotor Ventilator Co., Minneapolis, Minn.

● Advertisement in this issue. See Index to Advertisers, page 306.

Tiffin Eaves Trough Co., Tiffin, O.
Uno Ventilator Co., Cliftondale, Mass.
Van Noorden Co., E. Boston, Mass.
Walker Jamar Co., Duluth, Minn.
Western Engineering & Mfg. Co., Los Angeles, Cal.
Willis Steel Corp., Galesburg, Ill.
York Corrugating Co., York, Pa.

VENTILATORS, UNIT

●Airtherm Mfg. Co., St. Louis, Mo.
Johnson Fan & Blower Corp., Chicago, Ill.
Nelson Corp., Herman, Moline, Ill.
●Nesbitt, Inc., John J., Philadelphia, Pa.
●New York Blower Co., Chicago, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Sturtevant Co., B. F., Boston, Mass.
●Trane Co., The, La Crosse, Wis.

VIBRATION ELIMINATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration

VIBRATION ISOLATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration

VISCOUS LIQUID PUMPS

See Pumps, Viscous Liquids

VISES, PIPE

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O. (Sawing—for tubing)
Billings & Spencer Co., Hartford, Conn.
Crown Die & Tool Co., Chicago, Ill.
Desmond-Stephen Mfg. Co., Urbana, O.
Erie Tool Wks., Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
International Nutyp Tool Co., Oswego, N. Y.
Jarecki Mfg. Co., Erie Pa.
Nye Tool & Machine Wks., The, Chicago, Ill.
Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O
Trimont Mfg. Co., Roxbury, Mass.
Vanderman Mfg. Co., Willimantic, Conn.
●Williams & Co., J. H., Buffalo, N. Y.
Yost Mfg. Co., Meadville, Pa.

VISE STANDS

See Stands, Pipe Vise

WALL THERMOSTATS

See Thermostats, Room or Wall

WARM AIR FURNACES

See Furnaces, Warm Air

WASHERS, AIR

●Air & Refrigeration Corp., New York, N. Y.
Airwasher Corp., Lansing, Mich.
American Blower Corp., Detroit, Mich.
Ames Co., W. R., San Francisco, Cal.
Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Ballantyne Co., Omaha, Neb.
Bayley Blower Co., Milwaukee, Wis.
Betz Air Conditioning Corp., Kansas City, Mo.
Bishop & Babcock Mfg. Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Columbus Heating & Ventilating Co., Columbus, O.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Industrial Sheet Metal Works, Inc., Detroit, Mich.
McLouth Air Conditioning Corp., Lansing, Mich.
Mellish & Murray Co., Chicago, Ill.
●Murray Mfg. Co., D. J., Wausau, Wis.
●New York Blower Co., Chicago, Ill.
Northern Blower Co., Cleveland, O.
Parks-Cramer Co., Fitchburg, Mass.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Ross Sprinkler Co., Pasadena, Cal.
Schmieg Sheet Metal Works, Detroit, Mich.
Spray Engineering Co., Somerville, Mass.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Sturtevant Co., B. F., Boston, Mass.
Supreme Heater & Ventilating Corp., St. Louis, Mo.
●Trane Co., The, La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Vilter Mfg. Co., Milwaukee, Wis.
Western Blower Co., Seattle, Wash.
York Ice Machinery Corp., York, Pa.

WATER CHILLERS

See Chillers, Water, for Air Conditioning and Refrigeration

WATER HEATERS

See Heaters, Indirect, Submerged; Heaters, Water

WATER METERS

See Meters, Water

WATER TREATMENT

See Treatment, Water, to Inhibit Corrosion

WATER VAPOR REFRIGERATION

See Compressors, Refrigerating, Centrifugal; and Compressors, Refrigerating, Steam Jet

WELDERS, ARC

●Air Reduction Sales Co., New York, N. Y.
Allied Weld-Craft, Inc., Indianapolis, Ind.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bear Mfg. Co., Rock Island, Ill.
Borm Mfg. Co., Elgin, Ill.
Burke Electric Co., Erie, Pa.
Commonwealth Electric Welder Mfg. Co., Philadelphia, Pa.
Eisler Engineering Corp., Newark, N. J.
Electric Arc, Inc., Newark, N. J.
Emerson Electric Mfg. Co., The, St. Louis, Mo.
Ergolyte Mfg. Co., Philadelphia, Pa.
Fern, Ralph, Scranton, Pa.
●General Electric Co., Schenectady, N. Y.
General Equipment Co., Wichita, Kan.
Giant Grip Mfg. Co., Oshkosh, Wis.
Hammett Electric Mfg. Co., Kansas City, Mo.
Hampton Electric Mfg. Co., Pittsburgh, Pa.
Harnischfeger Corp., Milwaukee, Wis.
Hobart Bros. Co., Troy, O.
Hollup Corp., Div. of National Cylinder Gas Co., Chicago, Ill.
Ideal Electric & Mfg. Co., Mansfield, O.
Lee Co., K. O., Aberdeen, S. D.
Lincoln Electric Co., Cleveland, O.
Maple Valley Mfg. Co., Mapleton, Ia.
Marquette Mfg. Co., Minneapolis, Minn.
Miller Electric Mfg. Co., Inc., Appleton, Wis.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Sight Feed Generator Co., Richmond, Ind.
Smith Welding Equipment Corp., Minneapolis, Minn.
Star Electric Motor Co., Bloomfield, N. J.
Trindl Products, Ltd., Chicago, Ill.
Una Welding, Inc., Cleveland, O.
Universal Power Corp., Cleveland, O.
Welding Apparatus Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Will-Weld Mfg. Co., Inc., Omaha, Neb.
Wilson Welder & Metals Co., Inc., New York, N. Y.

WELDERS, SPOT

Acme Electric Welder Co., Los Angeles, Cal.
Agnew Electric Co., Milford, Mich.
Alphil Spot Welding Co., New York, N. Y.
Dyer Welder & Engineering Co., Kansas City, Mo.
Eisler Engineering Corp., Newark, N. J.
Electric Arc, Inc., Newark, N. J.
Federal Machine & Welder Co., Warren, O.
Micro Products Co., Chicago, Ill.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Taylor-Hall Welding Corp., Worcester, Mass.
Taylor-Winfield Corp., Warren, O.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Universal Power Corp., Cleveland, O.
Weldex, Inc., Detroit, Mich.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

● Advertisement in this issue. See Index to Advertisers, page 306.

WELDING AND CUTTING APPARATUS. OXY-ACETYLENE

●Air Reduction Sales Co., New York, N. Y.
Dockson Corp., Detroit, Mich.
Gasweld Equipment Div., Liquid Carbonic Corp., Chicago, Ill.
Harris Calorific Co., The, Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Liquid Carbonic Corp., The, Chicago, Ill.
Milburn Co., Alexander, Baltimore, Md.
Modern Engineering Co., St. Louis, Mo.
National Cylinder Gas Co., Chicago, Ill.
Ransome Machinery Co., Dunellen, N. J. (welding positioner)
Smith Welding Equipment Corp., Minneapolis, Minn.
Tempil Corp., New York, N. Y. (temperature indicators)
Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.
Universal Power Corp., Cleveland, O.

WELDING FUME COLLECTORS

See Exhausters, Welding Fume

WELDING PIPE CLAMPS

See Clamps, Pipe, Welding

WELDING RINGS

See Rings, Welding

WELDING ROD

See Rod, Gas Welding

WHEELS, BLOWER

Advance Alumnium Castings Corp., Chicago, Ill.
Air Controls, Inc., Cleveland, O.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Mfg. Co., Cleveland, O.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
Economy Electric Mfg. Co., Chicago, Ill.
Hastings Air Conditioning Co., Hastings, Neb.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Janette Mfg. Co., Chicago, Ill.
Lau Blower Co., Dayton, O.
Morrison Products, Inc., Cleveland, O.
●New York Blower Co., Chicago, Ill.
Palmer's Mfg. Corp., Phoenix, Ariz.
Peerless Electric Co., Warren, O.
Schwitzer-Cummins Co., Indianapolis, Ind.
Sturtevant Co., B. F., Boston, Mass.
●Torrington Mfg. Co., Torrington, Conn.
Triangle Mfg. Co., Oshkosh, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.

WHITE PRINT MACHINES

See Machines, Blue Print and White Print

WINDOW VENTILATOR AND FILTER UNITS

See Units, Window Ventilator and Filter

WINDOWS, HEAT INSULATING

Advance Insulating Co., Pittsburgh, Pa.
Andersen Corp., Bayport, Minn.
Bache, Semon & Co., New York, N. Y.
Chamberlin Metal Weather Strip Co., Detroit, Mich.
Detroit Steel Products Co., Detroit, Mich.
Kane Mfg. Corp., Kane, Pa.
Libbey-Owens Ford Glass Co., Toledo, O.
Mississippi Glass Co., New York, N. Y.
Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Russell Co., F. C., Cleveland, O.
Truscon Steel Co., Youngstown, O.

WOOD PIPE

See Pipe, Wood

WRENCHES, ADJUSTABLE

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
●Bonney Forge & Tool Works, Allentown, Pa.
Crescent Tool Co., Jamestown, N. Y.
Erie Tool Works, Erie, Pa.
Peck, Stow & Wilcox Co., Southington, Conn.
Snap-On Tools Corp., Kenosha, Wis.
Techtmann Industries, Inc., Milwaukee, Wis.
Trimont Mfg. Co., Boston, Mass.

WRENCHES, OPEN END

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Blackhawk Mfg. Co., Milwaukee, Wis.
●Bonney Forge & Tool Works, Allentown, Pa.
Snap-On Tools Corp., Kenosha, Wis.
Techtmann Industries, Inc., Milwaukee, Wis.
●Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, PIPE

Armstrong Bros. Tool Co., Chicago, Ill.
Bernz Co., Inc., Otto, Rochester, N. Y.
Billings & Spencer Co., Hartford, Conn.
●Bonney Forge & Tool Works, Allentown, Pa.
Erie Tool Works, Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
International Nutyp Tool Co., Oswego, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Ridge Tool Co., Elyria, O.
Snap-On Tools Corp., Kenosha, Wis.
Trimont Mfg. Co., Boston, Mass.
USHCO Mfg. Co., Inc., Buffalo, N. Y.
Walworth Co., New York, N. Y.

WRENCHES, RATCHET

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Blackhawk Mfg. Co., Milwaukee, Wis.
●Bonney Forge & Tool Works, Allentown, Pa.
Dresser Mfg. Co., Bradford, Pa.
Greene, Tweed & Co., New York, N. Y.
Lowell Wrench Co., Worcester, Mass.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, SOCKET

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Blackhawk Mfg. Co., Milwaukee, Wis.
●Bonney Forge & Tool Works, Allentown, Pa.
Chicago Pneumatic Tool Co., New York, N. Y. (pneumatic)
Lowell Wrench Co., Worcester, Mass.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, TORQUE INDICATING

Automotive Maintenance Machinery Co., North Chicago, Ill
Blackhawk Mfg. Co., Milwaukee, Wis.
●Bonney Forge & Tool Works, Allentown, Pa.
Dresser Mfg. Co., Bradford, Pa.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., Buffalo, N. Y.

WROUGHT IRON PIPE

See Pipe, Wrought Iron

WROUGHT IRON SHEETS

See Sheets, Wrought Iron

X-RAY MACHINES AND FILM

See Machines and Film, X-Ray

ZINC SHEETS

See Sheets, Zinc

ZONE CONTROLS

See Systems, Heating, Zone Control

● Advertisement in this issue. See Index to Advertisers, page 306.

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS

PART 2– TRADE NAMES

A-B—Motor controllers. Allen-Bradley Co., Milwaukee, Wis.

ABC—Humidifiers. American Blower Corp., Detroit, Mich.

AGP—Heaters. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

A-P—Damper operators, regulators, strainers, thermostats, valves. Automatic Products Co., Milwaukee, Wis.

A.R.A.—Non-metallic sheets and board. Wilson, Inc., Grant, Chicago, Ill.

ARRC—Fittings. Union Metal Wks., Inc., Chelsea, Mass.

ASBO—Ventilators. American Steel Band Co., Pittsburgh, Pa.

Abrasoweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Absorbex—Insulation. Celotex Corp., The, Chicago, Ill.

Ace—Damper regulators. Martens & Stormoen, Boston, Mass.

Ace—Pipe, pipe and fittings, tanks, valves, pumps. American Hard Rubber Co., New York, N. Y.

Ace—Welders. Pier Equipment Mfg. Co., Benton Harbor, Mich.

Acme—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Acousteel—Insulation. Celotex Corp., The, Chicago, Ill.

Acousti-Celotex—Insulation. Celotex Corp., The, Chicago, Ill.

Acoustilite—Insulation. Insulite Co., Minneapolis, Minn.

Acratherm—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Adamant—Fire brick cement. Botfield Refractories Co., Philadelphia, Pa.

Ada-Stic — Insulating cement. Botfield Refractories Co., Philadelphia, Pa.

Adjustiblade—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Adjusto—Packing. Keasbey & Mattison Co., Ambler, Pa.

Adjust-O-Feeder—Pumps, water treatment. % Proportioneers, Inc. %, Providence, R. I.

Adjustor — Heating systems. Kehm Corp., The, Chicago, Ill.

Adsco—Coils, conduit, heaters, joints, meters, pipe, pipe hangers and supports, pipe protectors, separators, strainers, regulators, valves. American District Steam Co., North Tonawanda, N. Y.

Adsco-Bannon—Conduit. American District Steam Co., North Tonawanda, N. Y.

Adsco Rotary—Condensation meters. American District Steam Co., North Tonawanda, N. Y.

Adsco Vertical—Traps. American District Steam Co., North Tonawanda, N. Y.

Aeracool—Blades, fans, louvers and shutters, ventilators. Myers Electric Co., Inc., Pittsburgh, Pa.

Aerisweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Aero—Roof ventilators. Jordan & Co., Paul R., Indianapolis, Ind.

Aero-Art—Radiation. National Radiator Co., The, Johnstown, Pa.

Aerocrat—Fans, washers. Ames Co., W. R., San Francisco, Cal.

Aerofuse — Air diffusers. Tuttle & Bailey, Inc., New Britain, Conn.

Aeroplane—Roof ventilators. Jordon & Co., Paul R., Indianapolis, Ind.

Aeroplex—Fans. Bayley Blower Co., Milwaukee, Wis.

Aeropull—Roof ventilators. Jordan & Co., Paul R., Indianapolis, Ind.

Aerospot—Fans. South Bend Air Products Corp., South Bend, Ind.

Aerovalve—Ventilators. Knowles Mushroom Ventilator Co., Montclair, N. J.

Afco—Fans, heaters. American Furnace Co., St. Louis, Mo.

Affco—Grilles, hangers, louvers and shutters. American Foundry & Furnace Co., Bloomington, Ill.

Agitair—Air diffusers, grilles, heaters, vanes. Air Devices, Inc., New York, N. Y.

Air Beam—Fans. Hall Mfg. Co., Cedar Rapids, Ia.

Air Lader—Air diffusers, louvers and shutters. Guth Co., Edwin F., St. Louis, Mo.

Air Stone—Conduit. Dockstader, S. E., Washington, D. C.

Air Vane—Grilles, registers. Rock Island Register Co., Rock Island, Ill.

Air Control—Fans, heaters, unit air conditioners. Hastings Air Conditioning Co., Hastings, Neb.

Airacoustic — Insulation. Johns-Manville, New York, N. Y.

Airate—Ventilators. Aeolus Dickinson, Chicago, Ill.

Air-A-Way—Ventilators. American Metal Products Co., Fort Worth, Tex.

Airblanket—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Airco—Welding rod, solder, pipe cutting machines. Air Reduction Sales Co., New York, N. Y.

Air-Con—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Airefiner—Water treatment. Oakite Products, Inc., New York, N. Y.

Airex—Fans, louvers and shutters, unit air conditioners. Mountain States Equipment Co., Denver, Colo.

Air-Fan—Window ventilator units. Reliable Sheet Metal Engineering Co., Chicago, Ill.

Air-flo—Louvers and shutters. Belanger Fan & Blower Co., Detroit, Mich.

Air-flo—Dampers, louvers and shutters. Air Conditioning Products Co., Detroit, Mich.

Airflow—Ventilators. Aeolus Dickinson, Chicago, Ill.

Airfoil—Fans, fan blades. Aerovent Fan Co., Piqua, O.

Airguide—Hygrometers, thermometers. Fee and Stemwedel, Inc., Chicago, Ill.

Airheator—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Airidge—Ventilators. Aeolus Dickinson, Chicago, Ill.

Airistocrat — Fan blades. Torrington Mfg. Co., Torrington, Conn.

Airkem—Odor adsorbers. Airox Co., New York, N. Y.

Airline—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Airlok — Insulation. Plastegon Wall Board Co., Buffalo, N. Y.

Airmat Arrester—Dust collectors. American Air Filter Co., Inc., Louisville, Ky.

Airmixt—Gas and oil burners. Williams, Inc., F. C., Dearborn, Mich.

Airofelt — Insulation. Johns-Manville, New York, N. Y.

Airo-Flex—Registers. Auer Register Co., Cleveland, O.

Air-o-Line — Indicator-controllers, recorder-controllers. Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

Air-O-Matic—Refrigerating machines. Williams Oil-O-Matic Corp., Bloomington, Ill.

Airotherm—Zone control thermostat. Tallmadge & Co., Webster, East Orange, N. J.

Airotor—Blower wheels. Torrington Mfg. Co., Torrington, Conn.

Airplex—Air filters. Davies Air Filter Corp., New York, N. Y.

Airstat — Regulators. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Airstream—Air filters. Brauer Supply Co., A. G., St. Louis, Mo.

Airstream—Blower wheels, fans. Morrison Products, Inc., Cleveland, O.

Airswitch—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Airvector—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Air-Vent—Fans. Airtherm Mfg. Co., St. Louis, Mo.

Air-X-Hausters—Roof ventilators. Breidert Co., G. C., Los Angeles, Cal.

Airxpel—Steam traps. Wright-Austin Co., Detroit, Mich.

Ajax—Ducts, fittings, ventilators. Cincinnati Sheet Metal & Roofing Co., Cincinnati, O.

Akon—Water treatment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Alco—Ventilators. Allen Corp., Detroit, Mich.

Alcoa—Angles, electrodes, sheets, tanks, tubing. Aluminum Co. of America, Pittsburgh, Pa.

Alkalex—Water treatment. Research Products Corp., Madison, Wis.

Allvent—Propeller fans. Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.

Alnor—Thermometers, air velocity meters. Illinois Testing Laboratories, Chicago, Ill.

Alorco—Dehydrators. Aluminum Co. of America, Pittsburgh, Pa.

Aloyco—Stainless steel fittings, nipples, pipe, tubing, unions, valves. Alloy Steel Products Co., Linden, N. J.

Alternarc—Arc welders. Electric Arc, Inc., Newark, N. J.

Aluminweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Always Reliable — Benders, cutters, leak detectors, torches, wrenches. Bernz Co., Inc., Otto, Rochester, N. Y.

Ambler—Cement. Keasbey & Mattison Co., Ambler, Pa.

Amco—Galvanizing powder. American Solder & Flux Co., Philadelphia, Pa.

Amco—Humidifiers, humidistats, hygrometers. American Moistening Co., Providence, R. I.

Amco—Packing. Austin-Mason Co., New York, N. Y.

American—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

American—Furnaces. American Foundry & Furnace Co., Bloomington, Ill.

American—Speed reducers. American Pulley Co., Philadelphia, Pa.

American—Vibration eliminators. American Metal Hose Branch, American Brass Co., Waterbury, Conn.

American — Pumps, water treatment. American Well Works, Aurora, Ill.

American—Pipe benders. American Pipe Bending Machine Co., Inc., Boston, Mass.

American — Water heaters. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Ames—Pumps. Domestic Engine & Pump Co., Shippensburg, Pa.

Amirglass — Filters. Amirton Co., New York, N. Y.

Ammco—Wrenches. Automotive Maintenance Machinery Co., North Chicago, Ill.

Ammonoduct—Pipe. Bethlehem Steel Co., Bethlehem, Pa.

Ampco—Dust collectors. American Metal Products Co., Fort Worth, Tex.

Anaconda—Fittings, pipe, welding rod, sheets, solder, tubing, valves. American Brass Co., Waterbury, Conn.

Anemo-light—Air diffusers. Anemostat Corp. of America, New York, N. Y.

Anemo-trol—Air diffusers. Anemostat Corp. of America, New York, N. Y.

Ankorite—Packing. Anchor Packing Co., Philadelphia, Pa.

Anode—Electrodes. Lincoln Electric Co., Cleveland, O.

Anti-Sweat — Insulation. Johns-Manville, New York, N. Y.

Apex—Pipe cutting and threading machines. Merrell Mfg. Co., Toledo, O.

Apex—Recorders. Uehling Instrument Co., Paterson, N. J.

Apexior — Coatings. Dampney Co. of America, Boston, Mass.

Aqua-Clear—Water treatment. Sudbury Laboratory, South Sudbury, Mass.

Aqualator—Circulators. Triplex Mfg. Co., Peru, Ind.

Aqua-Master—Water heaters. Century Engineering Corp., Cedar Rapids, Ia.

Aquaseal—Cement and compounds. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Aquatrol—Boiler cleaning compounds and water treatment. Aquatic Chemical Laboratories, Inc., New York, N. Y.

Aquazone—Humidifiers. Coroaire Heater Corp., The, Cleveland, Ohio.

Aqulux—Heaters. Johnson Co., S. T. Oakland, Cal.

Arc-Eng—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Arcmaster — Arc welders. Bear Mfg. Co., Rock Island, Ill.

Arco—Hangers, plates, radiation, regulators, valves. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Arex-Austor—Roof ventilators. Arex Co., Chicago, Ill.

Aridifier—Separators. Logan Engineering Co., Chicago, Ill.

Arin—Louvers and shutters. Arex Co., Chicago, Ill.

Aristocrat—Registers. Auer Register Co., Cleveland, O.

Armco—Pipe, sheets. American Rolling Mill Co., The, Middletown, O.

Armorak—Insulation. Keasbey Co., Robert A., New York, N. Y.

Arrow — Ventilators. Uno Ventilator Co., Cliftondale, Mass.

Arrowtrol—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Artic—Refrigerants. du Pont de Nemours & Co., E. I., Electrochemicals Dept., Wilmington, Del.

Asbestocel—Insulation. Johns-Manville, New York, N. Y.

Asco—Valves, relays, switches. Automatic Switch Co., New York, N. Y.

Atlas—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Atticvane—Fans. Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Autocoal—Stokers. Crane Co., Chicago, Ill.

Autocrat—Fan blades. Torrington Mfg. Co., Torrington, Conn.

Auto-Klean—Filters, strainers. Cuno Engineering Corp., Meriden, Conn.

Automatic — Motor bases. Ideal Commutator Dresser Co., Syracuse, Ill.

Automatic—Tube cleaners. Albright Equipment Co., Johnstown, Pa.

Auto-Tite—Pipe couplings. Superior Railway Products Corp., Pittsburgh, Pa.

Autovent — Eliminators, humidifiers, valves. Maid-O-Mist, Inc., Chicago, Ill.

Autozone—Zone control unit. Tallmadge & Co., Webster, East Orange, N. J.

Axiflo—Propeller fans. Sturtevant Co., B. F., Boston, Mass.

Axiom—Filters. Blocksom & Co., Michigan City, Ind.

B & B—Heating and air conditioning equipment. Bishop & Babcock Mfg. Co., Cleveland, O.

B. B.—Electric motors. Brown-Brockmeyer Co., Dayton, O.

BCA—Bearings. Bearings Co. of America, Lancaster, Pa.

B & C—Plates. Beaton & Corbin Mfg. Co., Southington, Conn.

B. & G. — Chillers, circulators, condensers, coolers, fittings, hangers, heaters, regulators, tanks, thermostats, valves. Bell & Gossett Co., Morton Grove, Ill.

B/W—Controllers, cut-offs, relays, switches. Bender Warrick Corp., Birmingham, Mich.

B & W—Boilers, burners, refractories, tubing, stokers, valves. Babcock & Wilcox Co., New York, N. Y.

Badger—Time switches. Reliance Automatic Lighting Co., Racine, Wis.

Balancer—Heating systems. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Balsam-Wool—Insulation. Wood Conversion Co., St. Paul, Minn.

Bankheat — Oil burners. Johnson Co., S. T., Oakland, Cal.

Bar-Brook—Unit air conditioners, fans. Shreveport Engineering Co., Inc., Shreveport, La.

Barcol—Humidistats, motors, operators, regulators, thermostats, valves. Barber-Colman Co., Rockford, Ill.

Barnes—Cutters. Erie Tool Works, Erie, Pa.

Barry—Bearings, pulleys and sheaves. Dick Co., Inc., R. & J., Passaic, N. J.

Barton-American — Pumps. American-Marsh Pumps, Inc., Battle Creek, Mich.

Battery—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Beacor—Valves. Beaton & Corbin Mfg. Co., Southington, Conn.

Bell—Cement. Keasbey & Mattison Co., Ambler, Pa.

Benco—Oil burners. Bennett Co., Omaha, Neb.

Benda Vane—Grilles. Rock Island Register Co., Rock Island, Ill.

Bend-Ezy—Grilles, registers. Standard Stamping & Perforating Co., Chicago, Ill.

Benton—Boilers. Combination Boiler Co., Benton Harbor, Mich.

Bertossa—Furnaces, heaters. Jackson & Church Co., Saginaw, Mich.

Beth-Co-Weld—Pipe. Bethlehem Steel Co., Bethlehem, Pa.

Beth-Cu-Loy—Sheets. Bethlehem Steel Co., Bethlehem, Pa.

Big Midget—Soot blowers. Sturtevant Co., B. F., Boston, Mass.

Bildrite—Insulation. Insulite Co., Minneapolis, Minn.

Billmyre—Air compressors. Allen Billmyre Corp., Mamaroneck, N. Y.

Binoc—Thermometers. Taylor Instrument Companies, Rochester, N. Y.

Birm — Water treatment. Research Products Corp., Madison, Wis.

Bison—Boilers. Farrar & Trefts, Buffalo, N. Y.

Bitugloss — Lacquers and enamels. Wailes Dove-Hermiston Corp., Westfield, N. J.

Bitumastic—Protective coatings. Wailes Dove-Hermiston Corp., Westfield, N. J.

Bloapco—Dust collectors. Blower Application Co., Milwaukee, Wis.

Blue-Point—Drills, tools, wrenches. Snap-On Tools Corp., Kenosha, Wis.

Blue Ribbon—Hangers or brackets, nipples, plates. Chicago Nipple Mfg. Co., Chicago, Ill.

Branford—Unions. Malleable Iron Fittings Co., Branford, Conn.

Brazarc—Electrodes. Universal Power Corp., Cleveland, O.

Brazo—Solder. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Breeze Spreader—Propeller fans. Victor Electric Products, Inc., Cincinnati O.

Breezo—Fans. Buffalo Forge Co., Buffalo, N. Y.

Bro-For — Boiler compounds. Brown-Ford Corp., Newton, Mass.

Broomell—Eliminators, floats, heating systems, traps, valves. Vapor Specialty Co., New York, N. Y.

BTUnit—Unit heaters. Industrial Mfg. & Engineering Co., Chicago, Ill.

Buf-flow—Propeller fans. Buffalo Forge Co., Buffalo, N. Y.

Bull Dog—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Bull Pup—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Burnham — Compressors, condensers, pumps. Union Steam Pump Co., Battle Creek, Mich.

Butler—Stokers. Whiting Stoker Co., Chicago, Ill.

C-E—Boilers. Combustion Engineering Co., New York, N. Y.

C-H—Controllers and starters, heaters, relays, switches, valves. Cutler-Hammer, Inc., Milwaukee, Wis.

CJB—Bearings. Ahlberg Bearing Co., Chicago, Ill.

C & M—Hangers or brackets. Carty & Moore Engineering Co., Detroit, Mich.

C. N. I.—Pipe. Walworth Co., New York, N. Y.

COM—Blowers. Wing Mfg. Co., L. J., New York, N. Y.

CW—Pipe. Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.

Cadillac—Meters. Central Station Steam Co., Detroit, Mich.

Cadman—Valves. Barrett Machine Co., N. S., Pittsburgh, Pa.

Cadwell—Pressure regulators, valves. Beaton & Cadwell Mfg. Co., New Britain, Conn.

Calicel—Insulation. Celotex Corp., The, Chicago, Ill.

Calistone—Insulation. Celotex Corp., The, Chicago, Ill.

Calktite—Cement and compounds. U. S. Stonewear Co., New York, N. Y.

Caloride—Dehumidifiers. Solvay Sales Corp., New York, N. Y.

Calorider—Dehumidifiers. General Air Conditioning Corp., Cincinnati, O.

Calorider—Dehumidifiers, humidifiers, unit air conditioners. Research Corp., New York, N. Y.

Cameo—Radiation. Weil-McLain Co., Chicago, Ill.

Cantilever—Hygrometers. Standard Thermometer, Inc., Boston, Mass.

Capillary—Air washers, dehumidifiers. Air & Refrigeration Corp., New York, N. Y.

Capitol—Boilers, hangers or brackets, heaters, radiation. United States Radiator Corp., Detroit, Mich.

Capitol—Insulation. Standard Lime & Stone Co., Baltimore, Md.

Capitolaire—Unit air conditioners. United States Radiator Corp., Detroit, Mich.

Carbo-Cooler—Cooling surface. Mojonnier Bros. Co., Chicago, Ill.

Careyduct—Ducts and duct fittings. Carey Mfg. Co., Philip, Cincinnati, O.

Castirnarc—Electrodes. Universal Power Corp., Cleveland, O.

Castolin — Solder and welding rod. Eutectic Welding Alloys Co., New York, N. Y.

Cataract — Centrifugal pumps. Red Jacket Mfg. Co., Davenport, Ia.

Causul—Valves. Lunkenheimer Co., Cincinnati, O.

Cell-U-Blanket — Insulation. Masonite Corp., Chicago, Ill.

Cellufoam—Insulation. Masonite Corp., Chicago, Ill.

Celoron—Couplings. Continental Diamond Fibre Co., Newark, Del.

Celo-Siding—Insulation. Celotex Corp., The, Chicago, Ill.

Cemesto—Insulation. Celotex Corp., The, Chicago, Ill.

Central—Conduit. Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.

Centri-Jet—Centrifugal pumps. Red Jacket Mfg. Co., Davenport, Ia.

Centrimax—Meters. Leeds & Northrup Co., Philadelphia, Pa.

Centripac—Packing. Johns - Manville, New York, N. Y.

Centripeller—Roof ventilators. Jordan & Co., Paul R., Indianapolis, Ind.

Centrispray — Air conditioning units. Bahnson Co., Winston-Salem, N. C.

Chaco—Cement and compounds, boiler and radiator sealing compounds. Desolvo Co., The, Pittsburgh, Pa.

Champion—Furnaces, heaters. National Heating Co., Minneapolis, Minn.

Charavay—Propeller fans, unit heaters. Hartzell Propeller Fan Co., New York, N. Y.

Charm—Radiation. Thatcher Furnace Co., Garwood, N. J.

Chevron — Packing. Garlock Packing Co., Palmyra, N. Y.

Chicago—Brakes. Dreis & Krump Mfg. Co., Chicago, Ill.

Chief—Packing. Keasbey & Mattison Co., Ambler, Pa.

Chieftain — Compressors. Tecumseh Products Co., Tecumseh, Mich.

Chieftain—Stokers. Conco Corp., Div. of H. D. Conkey & Co., Mendota, Ill.

Chill-Vactor—Steam jet compressors. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Chinook—Ferrous heating surface. Bayley Blower Co., Milwaukee, Wis.

Chinookfin—Non-ferrous heating surface. Bayley Blower Co., Milwaukee, Wis.

Chip Chaser—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Chromalox—Preheaters, unit heaters. Wiegand Co., Edwin L., Pittsburgh, Pa.

Chronoflo—Flow meters, recorders. Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.

Chronometer—Valves. Defender Automatic Regulator Co., St. Louis, Mo.

Chronotherm—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Circle T—Switches. Trumbull Electric Co., Plainville, Conn.

Circo—Louvers and Shutters. Circulators & Devices Mfg. Corp., New York, N. Y.

CirCOOLator—Fans, ventilators. Viking Air Conditioning Corp., Cleveland, O.

Clamp-A-Leak—Pipe repair clamps. Chelsea Metal Stamping Co., New York, N. Y.

Clarco—Unit heaters. Clarage Fan Co., Kalamazoo, Mich.

Clark-Sundh — Motor controls. Clark Controller Co., Cleveland, O.

Classic—Registers. Auer Register Co., Cleveland, O.

Cleanair—Aftercoolers. Bell & Gossett Co., Morton Grove, Ill.

Cle-Bar—Heaters. Cleghorn Co., Boston, Mass.

Climate Changer—Unit air conditioners, unit air coolers. Trane Co., The, La Crosse, Wis.

Climax—Unions. Devlin Mfg. Co., Inc., Thos., Burlington, N. J.

Closin—Bolts. Star Expansion Bolt Co., New York, N. Y.

Cocheco—Belting. Williams & Son, I B., Dover, N. H.

Code-Craft—Headers, heaters, preheaters, tanks. Zallea Brothers & Johnson, Wilmington, Del.

Coey—Cooling towers. Research Corp., New York, N. Y.

Colalloy—Couplings, fittings, flanges, nipples, pipe, sheets, structural shapes, tubing, unions, valves. Colonial Alloys Co., Metals Div., Philadelphia, Pa.

Cold Stream—Unit air conditioners Baker Ice Machine Co., Inc., Omaha, Nebr.

Colonial—Registers. Auer Register Co., Cleveland, O.

Columbia—Odor adsorbers. Carbide and Carbon Chemicals Corp., New York, N. Y.

Combustioneer—Stokers. Steel Products Engineering Co., Springfield, O.

Comet—Fans, unit heaters. New York Blower Co., Chicago, Ill.

Comfort-Air—Humidifiers. Comfort Products Corp., Harvey, Ill.

Comfortrol—Effective temperature control. Friez & Sons, Julien P., Towson, Md.

Comfostat—Thermostats. Johnson - Service Co., Milwaukee, Wis.

Co-Min-Co—Insulating cement. United States Mineral Wool Co., Chicago, Ill.

Compact—Radiation. Kohler Co., Kohler, Wis.

Compak—Valves. Commonwealth Brass Corp., Detroit, Mich.

Compass — Belting. Goodyear Tire & Rubber Co., Akron, O.

Concavex—Bearings. Shafer Bearing Corp., Chicago, Ill.

Conco—Boiler cleaning compounds, water treatment. Continental Products Co., Euclid, O.

Condor—Belting, V belts, pipe. Manhattan Rubber Mfg. Div. of Raybestos Manhattan, Inc., Passaic, N. J.

Condo-Vac—Vacuum pumps. Chicago Pump Co., Chicago, Ill.

Con-Vane—Ventilators. Allen Corp., Detroit, Mich.

Con-Tac-Tor — Switches. Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

Continental—Stokers. Whiting Stoker Co., Chicago, Ill.

Control-O-Gas—Valves. Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.

Convector—Humidifiers. Maid-O-Mist, Inc., Chicago, Ill.

Coolair—Fans. American Coolair Corp., Jacksonville, Fla.

Coolite — Windows. Mississippi Glass Co., New York, N. Y.

Coolvent—Fans. Autovent Fan & Blower Div., The Herman Nelson Corp., Chicago, Ill.

Copaltite—Cement and compounds, gaskets. National Engineering Products, Inc., Washington, D. C.

Copes—Governors, steam desuperheaters, valves. Northern Equipment Erie, Pa.

Cop-R-Loy—Steel sheets. Wheeling Corrugating Co., Wheeling, W. Va.

Cop-R-Loy—Sheets. Wheeling Steel Corp., Wheeling, W. Va.

Coravol—Corrosion treatment. Western Chemical Co., Kansas City, Mo.

Corkoustic — Insulation. Armstrong Cork Co., Lancaster, Pa.

Cottrell—Dust collectors. Research Corp., New York, N. Y.

Crescent—Boiler gage cocks. Wright-Austin Co., Detroit, Mich.

Crescent—Burners. Caloroil Burner Corp., Hartford, Conn.

Crescent—Unions. Star Mfg. Co., Inc., Providence, R. I.

Cromaloy—Solder. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Crown—Cement and compounds. Colebrook & Sons, Inc., W. H., Syracuse, N. Y.

Crucibleweld — Electrodes. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Cub—Unions. Rhode Island Fittings Co., Hillsgrove, R. I.

Cushiontone — Insulation. Armstrong Cork Co., Lancaster, Pa.

Cutno—Packing. Greene, Tweed & Co., New York, N. Y.

Cycloidal—Air washers. Blower Application Co., Milwaukee, Wis.

Cyclops—Roller bearings. Roller Bearing Co. of America, Trenton, N. J.

Cyclotherm — Boilers. Ames Iron Works, Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Cyclotherm—Boilers. General Furnaces Corp., New York, N. Y.

DH—Ball bearings. Dodge Mfg. Corp., Mishawaka, Ind.

D & H — Evaporative condensers, cooling and heating surfaces, unit air conditioners. Drayer & Hanson, Inc., Los Angeles, Cal.

DL—Filters, gages, regulators, relays, switches, thermostats, valves. Detroit Lubricator Co., Detroit, Mich.

DV—Speed changers, v-belt drives. Dodge Mfg. Corp., Mishawaka, Ind.

Damit—Caulking compounds. Quigley Co., Inc., New York, N. Y.

Dart—Unions. Fairbanks Co., New York, N. Y.

Daytex—Cord. Dayton Rubber Mfg. Co., Dayton, O.

Dean—Cleaners. Pierce Co., Wm. B., The, Buffalo, N. Y.

Debecote—Protective coatings. Debevoise Co., The, Brooklyn, N. Y.

Defender—Heaters. Handley Brown Heater Co., Jackson, Mich.

Deflecto—Roof ventilators. Day Co., The, Minneapolis, Minn.

Deflect-O-Grille—Grilles. U. S. Air Conditioning Corp., Minneapolis, Minn.

DeLuxe — Strainers. Blackmer Pump Co., Grand Rapids, Mich.

Demandtrol—Valves. Sullivan Valve & Engineering Co., Butte, Mont.

De-Sta-Co—Fan housings, pipe clamps, valves. Detroit Stamping Co., Detroit, Mich.

Detroit—Traps. Nason Co., Detroit, Mich.

Detroit LoStoker—Stokers. Detroit Stoker Co., Detroit, Mich.

Detroit Unistoker — Stokers. Detroit Stoker Co., Detroit, Mich.

Dew-Aire — Air conditioning units. Standard Computing Scale Co., The, Air Conditioning & Refrigeration Div., Detroit, Mich.

Dexter—Valve reseaters. Leavitt Machine Co., Orange, Mass.

Dexter-Goebel — Systems, regulators. National Brass Co., Grand Rapids, Mich.

Di-Acro—Benders, brakes, shears. O'Neil Irwin Mfg. Co., Inc., Minneapolis, Minn.

Diamond Fibre—Gaskets. Continental Diamond Fibre Co., Newark, Del.

Diamond H — Switches, thermostats. Hart Mfg. Co., Hartford, Conn.

Dickbelt—Belting. Dick Co., Inc., R. & J., Passaic, N. J.

Dickrope—V belts. Dick Co., Inc., R. & J., Passaic, N. J.

Difr-enshal-Vacm — Heating systems. Dunham Co., C. A., Chicago, Ill.

Dilecto—Plastic pipe. Continental Diamond Fibre Co., Newark, Del.

Direct—Pipe fittings and flanges, separators, strainers. Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.

Directherm—Direct fired heaters. Airtherm Mfg. Co., St. Louis, Mo.

Discfin—Cooling surface. General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.

Disc-Loc — Registers. Knowles Mushroom Ventilator Co., Montclair, N. J.

Distributor — Radiation. Kehm Corp., The, Chicago, Ill.

Divide—Separators. Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.

Dominion—Gaskets, packing. Darcoid Co., Inc., New York, N. Y.

Dorex Kno-Draft—Air diffusers. Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.

Double Check — Boiler compounds. Hampton-Cross Co., The, Louisville, Ky.

Double Diamond — Hygrometers, recorders, psychrometers. H-B Instrument Co., Philadelphia, Pa.

Double-Seal—Copper tube fittings. Hays Mfg. Co., Erie, Pa.

Downblast—Unit heaters. Sturtevant Co., B. F., Boston, Mass.

Draftender—Dampers and damper regulators. Penn Electric Switch Co., Goshen, Ind.

Draftite—Cement, Keasbey & Mattison Co., Ambler, Pa.

Draftrite — Gages. Bacharach Industrial Instrument Co., Pittsburgh, Pa.

Drainator — Traps. Coe Mfg. Co., Painesville, O.

Dry-Ice — Refrigerants. Pure Carbonic, Inc., New York, N. Y.

Dry-paC—Insulation. Ric-wiL Co., Cleveland, O.

Dualarc — Arc welders. Electric Arc, Inc., Newark, N. J.

Dual-Clone—Dust collectors. Day Co., The, Minneapolis, Minn.

Dualsteel—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Dubbiseal—Insulation. Masonite Corp., Chicago, Ill.

Duco—Enamels and lacquers. du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.

Ductatherm — Thermostats. Mercoid Corp., The, Chicago, Ill.

Ductype—Fans. South Bend Air Products Corp., South Bend, Ind.

Dulux—Enamels and lacquers. du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.

Dunco—Relays, switches. Dunn, Inc., Struthers, Philadelphia, Pa.

Duoflo—Pipe line strainers. Sheffler-Gross Co., Philadelphia, Pa.

Duo-Stat — Heating systems, thermostats. Johnson Service Co., Milwaukee, Wis.

Duotrol—Regulators. Automatic Control Co., St. Paul, Minn.

Duplex—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Duplex—Pipe cutting machines. Bignall & Keeler Machine Works, Edwardsville, Ill.

Duplex—Pipe line strainers. Maid-O-Mist, Inc., Chicago, Ill.

Duplex—Tubing. Bridgeport Brass Co., Bridgeport, Conn.

DuraBilt—Registers. Auer Register Co., Cleveland, O.

Duradiant—Gas burners. Selas Co., The, Philadelphia, Pa.

Dura-Flex—Registers. Auer Register Co., Cleveland, O.

Dura-Fram—Valves. Detroit Lubricator Co., Detroit, Mich.

Dura-Line—Registers. Auer Register Co., Cleveland, O.

Durant—Pipe. Ehret Magnesia Mfg. Co., Valley Forge, Pa.

DuraSpeed—Sprinkler heads. Grinnell Co., Inc., Providence, R. I.

Durex—Bearings. General Motors Corp., Moraine Products Div., Dayton, O.

Duroline — Pipe. National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.

Dustkop—Dust collectors. Aget-Detroit Mfg. Co., Detroit, Mich.

Dust-Stop—Air filters. Owens-Corning Fiberglas Corp., Toledo, O.

Dustube—Dust collectors. American Foundry Equipment Co., Mishawaka, Ind.

Duxbak—Leather belting and packing. Schieren Co., Chas. A., New York, N. Y.

Dux-Sulation—Insulation. Wilson, Inc., Grant, Chicago, Ill.

Dynaflow—Fans. South Bend Air Products Corp., South Bend, Ind.

Dynetric—Balancing equipment. Gisholt Machine Co., Madison, Wis.

E-C—V belts. Goodyear Tire & Rubber Co., Akron, O.

EC & M—Motor controls. Electric Controller & Mfg. Co., Cleveland, O.

Eafco—Fittings. Eastern Foundry Co., Boyertown, Pa.

Eastwood—Boilers, radiation. Pierce Butler Radiator Corp., Syracuse, N. Y.

Easyclean—Strainers. Wright-Austin Co., Detroit, Mich.

Easy-Flo—Solder. Handy & Harman, New York, N. Y.

Easyweld—Electrodes. Universal Power Corp., Cleveland, O.

Eclipse — Compressors. Frick Co., Waynesboro, Pa.

Eclipse—Alarms, governors, regulators, traps, valves. Illinois Engineering Co., Chicago, Ill.

Eclipse—Hose. Bendix Aviation Corp., Philadelphia Div., Philadelphia, Pa.

Economizer — Nozzles. Bahnson Co., Winston-Salem, N. C.

Economy—Boilers, heaters. International Heater Co., Utica, N. Y.

Economy—Heating systems. Maid-O-Mist, Inc., Chicago, Ill.

Economy—Regulators. Dockson Corp., Detroit, Mich.

Economy—Unit ventilators. Arex Co., Chicago, Ill.

Edgeseal—Air filters. Wilson & Co., Chicago, Ill.

Ellico—Louvers and shutters. Hirschman Co., W. F., Buffalo, N. Y.

"88"—Pipe covering. Eagle-Picher Lead Co., Cincinnati, O.

Ejectoplaque—Air diffusers. Air & Refrigeration Corp., New York, N. Y.

Electric Filter Watchman—Gages. Herbusch Corp., The, St. Louis, Mo.

Electrifugal—Centrifugal pumps. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Electro-Matic—Air cleaners. American Air Filter Co., Inc., Louisville, Ky.

Electromode—Electric heaters. Electric Air Heater Co., Div., American Foundry Equipment Co., Mishawaka, Ind.

Electro-Sheet—Sheets. American Brass Co., Waterbury, Conn.

Electro-Wind—Ventilators. Allen Corp., Detroit, Mich.

Electrozone—Ozone apparatus. Automatic Pump & Softener Corp., Rockford, Ill.

Electrunite—Stainless steel tubing. Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.

Elgin—Arc welders. Borm Mfg. Co., Elgin, Ill.

Elgin — Louvers and shutters. Elgo Shutter & Mfg. Co., Detroit, Mich.

Elite—Registers. Auer Register Co., Cleveland, O.

Elm—Dampers. Elgo Shutter & Mfg. Co., Detroit, Mich.

Elturn—Duct turning vanes. Barber-Colman Co., Rockford, Ill.

Embee—Cement and compounds. Montgomery Bros., San Francisco, Cal.

Emco—Meters, regulators. Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Emergency—Steam traps. Wright-Austin Co., Detroit, Mich.

Enamel-Kote—Enamels and lacquers. Acme White Lead & Color Works, Detroit, Mich.

Enco—Burners, regulators. Engineer Co., New York, N. Y.

Enduro—Packing. Keasbey & Mattison Co., Ambler, Pa.

Enduro—Pipe, sheets, tubing. Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.

Enduro—Unions. Jefferson Union Co., Inc., Lockport, N. Y.

Entrained Combustion—Gas burners. Mettler Co., Lee B., Los Angeles, Cal.

Equatherm—Zone control thermostat. Tallmadge & Co., Webster, East Orange, N. J.

Equiflo—Valves. Grinnell Co., Inc., Providence, R. I.

Eroduct — Insulation. Ehret Magnesia Mfg. Co., Valley Forge, Pa.

Erwin—Dampers. Elgo Shutter & Mfg. Co., Detroit, Mich.

Eureka—Valves. Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.

Evactor—Pumps. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Evco—Valves. Electric Valve Mfg. Co., Inc., New York, N. Y.

Evenaction—Valves. Taylor Instrument Companies, Rochester, N. Y.

Everlast—Exhaust heads. Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.

Evrtyte—Valves. Strong, Carlisle & Hammond Co., Cleveland, O.

Excel — Unions. Jefferson Union Co., Inc., Lockport, N. Y.

Excelso — Water heaters. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Exhaustair—Fans. New York Blower Co., Chicago, Ill.

Exidust—Dust collectors. Allen Billmyre Corp., South Norwalk, Conn.

Extra Dry Esotoo—Liquid sulphur dioxide. Virginia Smelting Co., West Norfolk, Va.

Eye-Hye—Gages. Reliance Gauge Column Co., Cleveland, O.

E-Z-ON—Damper quadrants. Gerett Corp., M. A., Milwaukee, Wis.

Ezy-Kleen—Strainers. Blackmer Pump Co., Grand Rapids, Mich.

F & E—Stokers. Flynn & Emrich Co., Baltimore, Md.

Fabrikated—Grilles, registers. Independent Register Co., Cleveland, O.

Falcon—Heaters, preheaters. Swoboda, Inc., H. O., New Brighton, Pa.

Fan-Air—Gas burners. Mettler Co., Lee B., Los Angeles, Cal.

Fanmix—Burners. Coppus Engineering Corp., Worcester, Mass.

Farragut—Packing. Darcoid Co., Inc., New York, N. Y.

Fast's—Couplings. Koppers Co., Bartlett Hayward Div., Baltimore, Md.

Favorite—Ratchet wrenches. Greene, Tweed & Co., New York, N. Y.

Featherfin—Heating and cooling surface. Wing Mfg. Co., L. J., New York, N. Y.

Featherweight—Thermostats. Magnet Switch Co., Chicago, Ill.

Featherweight—Unit heaters. Wing Mfg. Co., L. J., New York, N. Y.

Fel-Pro—Gaskets, packing. Felt Products Mfg. Co., Chicago, Ill.

Fenestra — Heat insulating windows. Detroit Steel Products Co., Detroit, Mich.

Fenn's Rotary—Ventilators. Waverly Heating Supply Co., Boston, Mass.

Fenox—Compounds. Halowax Products Div., Union Carbide & Carbon Corp., New York, N. Y.

Fero — Radiation. Burnham Boiler Corp., Irvington, N. J.

Ferrenewo—Valves. Lunkenheimer Co., Cincinnati, O.

Ferrocast—Exhaust heads, ventilators. Aeolus Dickinson, Chicago, Ill.

Ferroclad—Insulation. Truscon Steel Co., Youngstown, O.

Ferro-Therm — Insulation. American Flange & Mfg. Co., Inc., New York, N. Y.

Ferroweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Fiberglas—Insulation. Owens-Corning Fiberglas Corp., Toledo, O.

Fiberlite—Insulation. Insulite Co., Minneapolis, Minn.

Fields—Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Filmflo—Deaerators. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Filteraire—Window ventilator and filter units. Davies Air Filter Corp., New York, N. Y.

Fin-Flex—Registers. Auer Register Co., Cleveland, O.

Findlay—Stokers. Bluffton Mfg. Co., The, Findlay, O.

Fin-Line—Registers. Auer Register Co., Cleveland, O.

Fire-Guard — Stokers. Peerless Mfg. Corp., Louisville, Ky.

Fire Tender—Stokers. Holcomb & Hoke Mfg.Co., Indianapolis, Ind.

Firefoil—Insulating panel. Carey Mfg. Co., Philip, Cincinnati, O.

Fireite—Furnace cement. Johns-Manville, New York, N. Y.

Fireset—Refractories. Walsh Refractories Corp., St. Louis, Mo.

Flatjet—Spray nozzles. Spraying Systems Co., Chicago, Ill.

Fleetweld—Welding electrodes. Lincoln Electric Co., Cleveland, O.

Fleet-X—Enamels and lacquers. Acme White Lead & Color Works, Detroit, Mich.

Flexarc—Arc welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Flexair—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Flexcord—Drives. Gates Rubber Co., Denver, Colo.

Flexeal—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Flexiwound—Gaskets. Azor Corp., Irvington, N. J.

Flexodisc — Expansion joints. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Flextan—Packing. Chicago Belting Co., Chicago, Ill.

Floatrol—Switches. Automatic Control Co., St. Paul, Minn.

Flo-Klean—Filters, strainers. Cuno Engineering Corp., Meriden, Conn.

Flo-scope—Meters. Selas Co., The, Philadelphia, Pa.

Flotrol — Valves. Monmouth Products Co., Cleveland, O.

Flotrol-Microfeed — Humidifiers. Monmouth Products Co., Cleveland, O.

Flo-watch — Flow meters. Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.

Flualyzer—Analyzers. Engelhard, Inc., Chas., Newark, N. J.

Flush-Kleen—Sewage ejectors. Chicago Pump Co., Chicago, Ill.

Forcedraft—Unit air coolers. Fedders Mfg. Co., Inc., Buffalo, N. Y.

Force-Flo—Circulators, heaters, regulators, systems. Kehm Corp., The, Chicago, Ill.

Fordair—Compressors. Schramm, Inc., West Chester, Pa.

Forest Fleece—Insulation. Doheny Co., John J., Belmont, Mass.

Formdux — Prefabricated ducts. Airtemp, Div. of Chrysler Corp., Dayton, O.

Fosco—Ventilators. Schoedinger, F. O. Columbus, O.

Francke—Flexible couplings. Waldron Corp., John, New Brunswick, N. J.

Fre-Flo — Strainers. Fisher Governor Co., Marshalltown, Ia.

Freon—Refrigerant. Kinetic Chemicals, Inc., Wilmington, Del.

Fretz—Nipples. Devlin Mfg. Co., Inc., Thos., Burlington, N. J.

Frevent—Valves. Russell & Co., W. A., Bridgeport, Conn.

Friction Fighter—Bearings. Link-Belt Co., Indianapolis, Ind.

Frigid—High pressure blowers, propeller fan blades and fans. Circulators & Devices Mfg. Corp., New York, N. Y.

Frigistat — Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Frigitower—Cooling towers. Schubert-Christy Corp., St. Louis, Mo.

Frostaire — Air conditioning units. Palmer Mfg. Corp., Phoenix, Ariz.

Fuel Saver — Boilers. International Boiler Wks. Co., East Stroudsburg, Pa.

Fulljet—Spray nozzles. Spraying Systems Co., Chicago, Ill.

Fulscope — Recorders, recorder - controllers, regulators. Taylor Instrument Companies, Rochester, N. Y.

Fyr-Feeder—Stokers. American Coal Burner Co., Chicago, Ill.

Fyrite — Analyzers. Bacharach Industrial Instrument Co., Pittsburgh, Pa.

G-E—Condensers. General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.

G-E Glow — Lamps. General Electric Co., Lamp Dept., Nela Park, Cleveland, O.

G-E Mazda — Lamps. General Electric Co., Lamp Dept., Nela Park, Cleveland, O.

G-M—Grilles, louvers and shutters, registers. Gillian Mfg. Co., Detroit, Mich.

G-Fin — Cooling and heating surface. Griscom-Russell Co., The, New York, N. Y.

G-R—Oil coolers, water chillers. Griscom-Russell Co., The, New York, N. Y.

G-R—Unit coolers and air conditioners. General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.

GTD—Pipe vises and wrenches. Greenfield Tap & Die Corp., Greenfield, Mass.

Gale—Ducts, grilles, registers. Char-Gale Mfg. Co., Minneapolis, Minn.

Gast—Filters, separators. Johnson Corp., Three Rivers, Mich.

Gasweld — Torches, welding rod and apparatus. Liquid Carbonic Corp., The, Chicago, Ill.

Geddes—Radiation. Fowler & Wolfe Radiator Co., Norristown, Pa.

Gemaco—Compressors. General Machinery Co., Spokane, Wash.

Gemware — Hygrometers, psychrometers, thermometers. G. M. Mfg. Co., New York, N. Y.

Genasco—Insulation, pipe joint cement and compounds. Barber Asphalt Corp., Barber, N. J.

Genspring—Pipe supports. Grinnell Co., Inc., Providence, R. I.

Genuine Stillson—Wrenches. Walworth Co., New York, N. Y.

Germicidal—Lamps. General Electric Co., Lamp Dept., Cleveland, O.

Geyser—Water heaters. Thatcher Furnace Co., Garwood, N. J.

Giant—Radiator hangers. Western Hanger Co., San Francisco, Cal.

Gilbarco—Compressors, regulators. Gilbert & Barker Mfg. Co., West Springfield, Mass.

Gilsonite—Protective coatings. Ohmlac Paint & Refining Co., Chicago, Ill.

Gilt Edge—Belting. Rhoads & Sons, J. E., Philadelphia, Pa.

Gimco — Insulation. National Gypsum Co., Buffalo, N. Y.

Gland-Pakt—Expansion joints. Yarnall-Waring Co., Philadelphia, Pa.

Glazola—Caulking compounds. Nebel Mfg. Co., Cleveland, O.

Globack—Pipe flanges. Midwest Piping & Supply Co., Inc., St. Louis, Mo.

Globe—Ventilators. Osborn Co., The J. M. & L. A., Cleveland, O.

Gloco Red Band—Water heaters. Glore Sales Corp., Evins F., New York, N. Y.

Glowan—Gas burners. Martin, J. O. & C. U., San Francisco, Cal.

Goetzerit—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Gohi — Sheets. Newport Rolling Mill Co., Newport, Ky.

Gold Bond—Insulation. National Gypsum Co., Buffalo, N. Y.

Gold-Seal—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Golden Rod—Blower wheels, fans, heaters, unit air conditioners. Jaden Mfg. Co., Inc., F., Hastings, Neb.

Goodyearite—Packing. Goodyear Tire & Rubber Co., Akron, O.

Grad-U-Motor—Damper operators. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Gradustat — Regulators, thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Gradutrol—Diaphragm valves. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Graylite—Insulation. Insulite Co., Minneapolis, Minn.

Greastop—Air filters. Air-Maze Corp., Cleveland, O.

Grid—Unit heaters. Murray Mfg. Co., D. J., Wausau, Wis.

Grillometer—Direct reading air velocity meters. Detroit Air Meter Co., Detroit, Mich.

Guardian—Gaskets. Garlock Packing Co., Palmyra, N. Y.

Gulf Stream—Water heaters. Marion Machine Foundry & Supply Co., Marion, Ind.

Gun-Pakt--Expansion joints. Yarnall-Waring Co., Philadelphia, Pa.

Guthfan—Fans. Guth Co., Edwin F., St. Louis, Mo.

H & C—Grilles, registers. Hart & Cooley Mfg. Co., Holland, Mich.

H.C.—Stokers. Whiting Stoker Co., Chicago, Ill.

H-O-H — Compounds, feeders, steam system and water treatment. Haering & Co., Inc., D. W., Chicago, Ill.

H-T—Smoke alarms. Au-Temp-Co Corp., New York, N. Y.

Hairbestos—Insulation. Wilson & Co., Chicago, Ill.

Haircraft—Insulation. Wilson & Co., Chicago, Ill.

Hammerkraft—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Hammermill—Belting. Goodyear Tire & Rubber Co., Akron, O.

Hammer-On—Damper quadrants. Air Control Products, Inc., Coopersville, Mich.

Hammer-Set—Bolts. Rawlplug Co., Inc., The, New York, N. Y.

Handy—Benders. Holsclaw Bros., Inc., Evansville, Ind.

Handy Andy—Vise stands. Western Wire Products Co., St. Louis, Mo.

Hardweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Hartman—Air conditioning units. Norwood Filtration Co., The, Florence, Mass.

Hartmann—Heaters. Montgomery Bros., San Francisco, Cal.

Haveg—Tanks. Continental Diamond Fibre Co., Newark, Del.

Hazleton—Pumps, strainers, valves. Barrett, Haentjens & Co., Hazleton, Pa.

Health-Air—Ventilator and filter units. Reliable Sheet Metal Engineering Co., Chicago, Ill.

Health-Aire—Fans, heaters, unit coolers, ventilators. Johnson Fan & Blower Co., Chicago, Ill.

Heart-Oak—Belting. Graton & Knight Co., Worcester, Mass.

Heat Breaker—Fans. Earl Co., Warren, Houston, Tex.

Heath—Manometers. Detroit Air Meter Co., Detroit, Mich.

Heatomat—Heaters. Richmond Radiator Co., Gas Products Div., Uniontown, Pa.

Heat-Rite — Registers. Auer Register Co., Cleveland, O.

Heggie-Simplex—Boilers. Lookout Boiler & Mfg. Co., Chattanooga, Tenn.

Helical—Tubing. Rome-Turney Radiator Co., Rome, N. Y.

Hensel—Welders. Maple Valley Mfg. Co., Mapleton, Ia.

Herculoy—Welding rod, tubing. Revere Copper and Brass, Incorporated, New York, N. Y.

Hevikont—Electrodes. Universal Power Corp., Cleveland, O.

Hiflo—Convection type radiation. Modine Mfg. Co., Racine, Wis.

Highflex—Belting. Goodrich Co., B. F., Akron, O.

High-Temp—Packing. Keasbey & Mattison Co., Ambler, Pa.

Hijet—Unit heaters. Nelson Corp., Herman, Moline, Ill.

Hilger—Chillers, refrigerating compressors, unit coolers, unit air conditioners, valves. XL Refrigerating Co., Inc., Chicago, Ill.

Hi-Lo — Alarms. Yarnall-Waring Co., Philadelphia, Pa.

Hi-Lo—Pumps. Yeomans Bros. Co., Chicago, Ill.

Hi-Seal—Cement and compounds. Greene, Tweed & Co., New York, N. Y.

Hi-Spra — Spray nozzles. Schubert-Christy Corp., St. Louis, Mo.

Hitchings—Boilers. Burnham Boiler Corp., Irvington, N. Y.

Hi-Temp—Insulation. Carey Mfg. Co., Philip, Lockland, Cincinnati, O.

Hi-Test—Pipe. Walworth Co., New York, N. Y.

Holby—Valves. Boiler Room Equipment, Inc., New York, N. Y.

Holdfast—Solder. American Brass Co., Waterbury, Conn.

Holt—Strainers, tube cleaners. Rosedale Foundry & Machine Co., Pittsburgh, Pa.

Holtite—Clamps. Yarnall-Waring Co., Philadelphia, Pa.

Horneblende — Caulking compounds. North American Fibre Products Co., The, Cleveland, O.

Horton—Tanks. Chicago Bridge & Iron Co., Chicago, Ill.

Hot Shot—Pumps. Yeomans Bros. Co., Chicago, Ill.

Hot Spot—Spot welders. Acme Electric Welder Co., Los Angeles, Cal.

Hotpoint—Water heaters. Edison General Electric Appliance Co., Inc., Chicago, Ill.

Hovalco—Valves. Homestead Valve Mfg. Co., Coraopolis, Pa.

Huber—Stokers. Flynn & Emrich Co., Baltimore, Md.

Humidair—Humidifiers. Skilbeck Mfg. Co., Kenosha, Wis.

Humid-Heet—Radiators. Utica Radiator Corp., Utica, N. Y.

Humidigrad — Humidifiers. Monmouth Products Co., Cleveland, O.

Humidigraph — Humidity recorders. Bristol Co., Waterbury, Conn.

Humidiguide—Hygrometers. Taylor Instrument Companies, Rochester, N. Y.

Humidostat—Humidistats. Johnson Service Co., Milwaukee, Wis.

Humiduct—Humidifiers. Bahnson Co., Winston-Salem, N. C.

Humi-Temps—Unit air coolers. Larkin Coils, Inc., Atlanta, Ga.

Humphrey—Unit heaters. General Gas Light Co., Kalamazoo, Mich.

Hurivent—Valves. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Hycarb—Electrodes. Universal Power Corp., Cleveland, O.

Hydra—Valves. Albright Equipment Co., Johnstown, Pa.

Hydramotor—Valves. General Controls Co., Glendale, Cal.

HydraStoker—Stokers. Detroit Stoker Co., Detroit, Mich.

Hydro—Recorders. Bacharach Industrial Instrument Co., Pittsburgh, Pa.

Hydro—Packing. Keasbey & Mattison Co., Ambler, Pa.

Hydro-Clone — Condensers, welding fume exhausters. Faraday Engineering Co., Boston, Mass.

Hydron—Bellows, traps. Clifford Mfg. Co., Boston, Mass.

Hydrovac—Pumps. Ames Hydrovac Corp., Brooklyn, N. Y.

Hydro-Whirl—Dust collectors. Industrial Sheet Metal Works, Inc., Detroit, Mich.

Hy-Duty—Blower wheels, fans. Schwitzer-Cummins Co., Indianapolis, Ind.

Hylo—Heating systems. Webster & Co., Warren, Camden, N. J.

Hy-Temp—Cement, insulation. Keasbey & Mattison Co., Ambler, Pa.

Hytempite—Cement, refractories. Quigley Co., Inc., New York, N. Y.

Hy-Test—Water heaters. Smith Co., Inc., H. B., The, Westfield, Mass.

Hytherstat—Combination humidity and temperature control. Friez & Sons, Julien P., Towson, Md.

Hytor—Pumps. Nash Engineering Co., South Norwalk, Conn.

I-R—Ingersoll-Rand, New York, N. Y.

Ice Engine—Gas and diesel engines. Waukesha Motor Co., Waukesha, Wis.

Ice-O-Matic — Refrigerating compressors. Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

Icy-Flo — Accumulators. McQuay, Inc., Minneapolis, Minn.

Ideal—Blowers. Perfection Grate & Stoker Co., Springfield, Mass.

Ideal—Boilers, water heaters, valves. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Ideal — Ventilators. Tuttle & Bailey, Inc., New Britain, Conn.

Ideal—Traps. Nason Co., Detroit, Mich.

Immersatherm — Thermostats. Mercoid Corp., The, Chicago, Ill.

Immersion-o-matic — Water heaters. Sellers Engineering Co., Chicago, Ill.

Impact—Spray nozzles. Cooling Tower Co., Inc., The, Div. of the Fluor Corp., Ltd., New York, N. Y.

Imperial—Boilers. National Radiator Co., The, Johnstown, Pa.

IngAclad—Stainless clad sheets. Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago, Ill.

In-Hib-Co—Protective coatings. Haering Co., Inc., D. W., Chicago, Ill.

Inkstop — Air filters. Air-Maze Corp., Cleveland, O.

Ins-lite—Insulation. Insulite Co., Minneapolis, Minn.

Instant—Heaters, preheaters. Johnson Corp., Three Rivers, Mich.

Insulag—Insulation. Quigley Co., Inc., New York, N. Y.

Insulblox—Insulation. Quigley Co., Inc., New York, N. Y.

Insulcrete—Insulating cement. Quigley Co., Inc., New York, N. Y.

Insulduct — Ducts and duct fittings. Smith-Raymond Co., Columbus, Ga.

Insulfil—Insulation. Refractory & Insulation Corp., New York, N. Y.

Insulwool—Insulation. General Insulating Products Co., Brooklyn, N. Y.

Insutube—Insulation. Union Asbestos & Rubber Co., Cicero, Ill.

Involute—Spray nozzles. Yarnall-Waring Co., Philadelphia, Pa.

Ionaire—Ionization apparatus. Electroaire Corp., Chicago, Ill.

Ironset—Furnace cement. Fireline Stove & Furnace Lining Co., Chicago, Ill.

Ironton—Burners. Continental Stove Corp., Ironton, O.

J F S—Speed changers and reducers. Stephens-Adamson Mfg. Co., Aurora, Ill.

J-M Ball—Foats, traps. Cryer Trap & Valve Co., Inc., New York, N. Y.

J. M. C.—Burners. Johnson Mfg. Co., Waterloo, Ia.

Janitrol—Burners, heaters, unit air conditioners. Surface Combustion, Toledo, O.

Jarco—Unions. Jarecki Mfg. Co., Erie, Pa.

Jennings—Pumps, ejectors. Nash Engineering Co., South Norwalk, Conn.

Jetal—Protective coatings. Alrose Chemical Co., Providence, R. I.

Jewel—Packing. Keasbey & Mattison Co., Ambler, Pa.

John Crane—Cement and compounds. Crane Packing Co., Chicago, Ill.

Jointite — Insulation. Mundet Cork Corp., Brooklyn, N. Y.

Jones—Stokers. Riley Stoker Corp., Worcester, Mass.

Julian d'Este—Controls, floats, governors, regulators, strainers, thermostats, traps, valves. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.

Junior — Radiation. Weil-McLain Co., Chicago, Ill.

Jusrite—Ducts and duct fittings. Corbman Bros., Inc., Philadelphia, Pa.

K—Fittings. Kuhns Brothers Co., Dayton, O.

K-Fin—Cooling and heating surface. Griscom-Russell Co., The, New York, N. Y

K and M—Alarms, controls, strainers, traps, valves. Kieley & Mueller, Inc., North Bergen, N. J.

K-S-V—Ventilators. Kernchen Co., Chicago, Ill.

Kable Kord—Belting. Gilmer Co., L. H., Philadelphia, Pa.

Kane—Boilers, gas burners. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Karbate—Carbon pipe. National Carbon Co., Carbon Sales Div., Cleveland, O.

Kathabar — Dehumidifiers, humidifiers, unit air conditioners. Surface Combustion, Toledo, O.

Kaukit—Caulking compounds. Sonneborn Sons, Inc., L., New York, N. Y.

Kearsarge—Gaskets, packing. Johns-Manville, New York, N. Y.

Kelly—Valves. National Metal Products Corp., Chicago, Ill.

Kentucky—Sheets. Newport Rolling Mill Co., Newport, Ky.

Key-Tite—Cement and compounds. Key Co., East St. Louis, Ill.

Kidskin—Packing. Darcoid Co., Inc., New York, N. Y.

Kimsul — Insulation. Kimberly-Clark Corp., Neenah, Wis.

King-clip—Valves. Lunkenheimer Co., Cincinnati, O.

King-Gage—Gages. King Engineering Corp., Ann Arbor, Mich.

Kitchenaire—Propeller fans. Allen Corp., Detroit, Mich.

Kleen Air—Air filters. Kaye & MacDonald, Inc., West Orange, N. J.

Kleen Tube—Heaters. Vapor Car Heating Co., Inc., Chicago, Ill.

Kleenflo — Unit air filters. Air-Maze Corp., Cleveland, O.

Klingtite—Belting. Goodyear Tire & Rubber Co., Akron, O.

Klixon—Temperature controls. Spencer Thermostat Co., Attleboro, Mass.

Klondike—Arc welders. Fern, Ralph, Scranton, Pa.

K-Master—Strainers, traps. Kaye & Macdonald, Inc., West Orange, N. J.

Knight-Ware — Pipe. Knight, Maurice A., Akron, O.

Kno-Draft—Air diffusers. Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.

Koldboard — Insulation. Baldwin-Hill Co., Trenton, N. J.

Kon-Nec-Tor—Mercury switches. General Electric Co., Lamp Dept., Cleveland, O.

Kool-Shade — Solar heat resisting screens. Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago, Ill.

Kooler-Aire—Commercial air conditioners. U. S. Air Conditioning Corp., Minneapolis, Minn.

Koven—Boilers. Waterfilm Boilers, Inc., Jersey City, N. J.

Krupp—Valves. Shank Co., Cyrus, Chicago, Ill.

L. A.—Motors. Louis Allis Co., Milwaukee, Wis.

L-M—Tubing. Lewin-Mathes Co., Lewin Metals Div., St. Louis, Mo.

L&N—Regulators. Leeds & Northrup Co., Philadelphia, Pa.

L-R—Couplings. Lovejoy Flexible Couplings Co., Chicago, Ill.

L. R. D.—Valves. Grinnell Co., Inc., Providence, R. I.

Laddi—Heaters. Johnson Co., S. T. Oakland, Cal.

Lamino—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Lavigne—Valves. Commonwealth Brass Corp., Detroit, Mich.

Lawson—Wrenches. USHCO Mfg. Co., Inc., Buffalo, N. Y.

Leader—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Lectrodryer—Dehumidifiers. Pittsburgh Lectrodryer Corp., Pittsburgh, Pa.

Lectro Shear—Shears. Black & Decker Mfg. Co., Towson, Md.

Ledaloyl—Sleeve bearings. Johnson Bronze Co., New Castle, Pa.

Levelometer—Gages, recorders. Liquidometer Corp., Long Island City, N. Y.

Liberty—Packing. Johns-Manville, New York, N. Y.

Lightning—Cleaning compounds. Western Chemical Co., Kansas City, Mo.

Lima—Stokers. Carnes, Inc., John R., Lima, O.

Limit-Load—Centrifugal fans. Buffalo Forge Co., Buffalo, N. Y.

Limitorque—Valves. Philadelphia Gear Works, Inc., Philadelphia, Pa.

Limpet—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Linabestos—Insulation. Celotex Corp., The, Chicago, Ill.

Lindsay Structure—Cabinet construction for air conditioning equipment. Dry-Zero Corp., Chicago, Ill.

Lin-X—Enamels and lacquers. Acme White Lead & Color Works, Detroit, Mich.

Lipman—Compressors, cooling surface. General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.

Liquivator—Pumps. Morehead Mfg. Co., Detroit, Mich.

Little Blacksmith — Punches, shears. Kidder Mfg. Co., Inc., J. F., Burlington, Vt.

Little Giant—Pipe extractors, vises, stocks and dies. Greenfield Tap & Die Corp., Greenfield, Mass.

Little Giant—Unit heaters. Nesbitt, Inc., John J., Philadelphia, Pa.

Little Giant—Radiation. Pierce Butler Radiator Corp., Syracuse, N. Y.

Little Giant—Switches, Tork Clock Co., Inc., Mt. Vernon, N. Y.

Lo-Blast—Burners. National Machine Wks., Chicago, Ill.

Locarb—Electrodes. Universal Power Corp., Cleveland, O.

Lockaire—Insulation. Plastergon Wall Board Co., Buffalo, N. Y.

Lodi—Boilers. Super Mold Corp., Lodi, Cal.

Lok-Joint — Insulation. Insulite Co., Minneapolis, Minn.

Loing—Heaters. American Instrument Co., Silver Spring, Md.

Lo-Maintenance—Motors and starters. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Longrip—Pipe extractors. Ridge Tool Co., Elyria, O.

Lord Burnham—Boilers. Burnham Boiler Corp., Irvington, N. Y.

Lowcost—Boilers. Murray Iron Wks., Co., Burlington, Ia.

Loxia—Bolts. Star Expansion Bolt Co., New York, N. Y.

Lubricore—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Lul—Unit coolers. Merchant & Evans Co., Philadelphia, Pa.

Luminarc—Electrodes. Universal Power Corp., Cleveland, O.

Lyonore—Sheets. Lyon, Conklin & Co., Inc., Baltimore, Md.

M. & E. — Refrigerating compressors. Merchant & Evans Co., Philadelphia, Pa.

MGC—Compressors. Hobart Bros. Co., Troy, O.

M & M — Alarms, cut-offs, feeders, humidifiers, operators, switches, valves. McDonnell & Miller, Chicago, Ill.

M & S—Gaskets, insulation. Mitchell & Smith, Inc., Detroit, Mich.

MIF — Couplings, fittings. Malleable Iron Fittings Co., Branford, Conn.

MJL—Gages, manometers, meters, recorders. Morey & Jones, Ltd., Los Angeles, Cal.

MKO—Boiler feeders, pumps. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

M-R-C—Ball bearings. Marlin-Rockwell Corp., Jamestown, N. Y.

M/W and A/C Airmat — Air filters. American Air Filter Co., Inc., Louisville, Ky.

Macheta—Fans, fan blades. Aerovent Fan Co., Piqua, O.

Magic-Weather—Air washers, air conditioning units, fans. Ballantyne Co., Omaha, Nebr.

Majestic — Boilers. Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Manganweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Mark Time—Time switches. Rhodes, Inc., M. H., Hartford, Conn.

Martell—Packing. France Packing Co., Tacony, Philadelphia, Pa.

Mascocement—Refractories. Munn and Steele, Inc., Newark, N. J.

Mascolite—Pipe insulation. Munn and Steele, Inc., Newark, N. J.

Mascote—Insulation. Munn and Steele, Inc., Newark, N. J.

Massachusetts — Fans, unit heaters, blower wheels, air washers. Bishop & Babcock Mfg. Co., Cleveland, O.

Master—Stokers. Muncie Gear Wks., Inc., Muncie, Ind.

Master—Thermostats, regulators, switches. White Mfg. Co., St. Paul, Minn.

Master—Unions. Jefferson Union Co., Inc., Lockport, N. Y.

Master Kraft—Oil burners, unit heaters and air conditioners. Harvey-Whipple, Inc., Springfield, Mass.

McDaniel—Floats, traps. Watson & McDaniel Co., Philadelphia, Pa.

McKee—Blowers, boilers, burners, feeders, pumps, regulators, tanks, torches, valves. Eclipse Fuel Engineering Co., Rockford, Ill.

McKeesport — Radiation. Columbia Radiator Co., McKeesport, Pa.

McKnight—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Measurrench — Wrenches. Williams & Co., J. H., Buffalo, N. Y.

Mechanovent—Ventilators. New York Blower Co., Chicago, Ill.

Meco—Regulators, torches, valves, welding rod. Modern Engineering Co., St. Louis, Mo.

Mellobiu—Gas burners. Beck Engineering Combustion Kompany, St. Louis, Mo.

Mel-Rock—Humidifiers, units, ventilators, washers. Mellish & Murray Co., Chicago, Ill.

Merkustat — Regulators, switches. Marsh Corp., Jas. P., Chicago, Ill.

Merrill Process — Heating systems. Parks-Cramer Co., Fitchburg, Mass.

Metal-Master—Shears. Wiss & Sons Co., J., Newark, N. J.

Metermax — Combustion control systems. Leeds & Northrup Co., Philadelphia, Pa.

Metric—Meters. American Meter Co., Inc., New York, N. Y.

Metrotherm — Thermostats. General Controls Co., Glendale, Cal.

Micro—Low water cut-offs. Maid-O-Mist, Inc., Chicago, Ill.

Micromax — Recorders, recorder-controllers, thermometers. Leeds & Northrup Co., Philadelphia, Pa.

Micromet—Water treatment. Calgon, Inc., Pittsburgh, Pa.

Microstat—Thermostats. Friez & Sons, Julien P., Towson, Md.

Microtherm—Thermostats. Barber-Colman Co., Rockford, Ill.

Micro-Weld—Spot welders. Micro Products Co., Chicago, Ill.

Midget — Radiation. Utica Radiator Corp., Utica, N. Y.

Mills—Boilers. Smith Co., Inc., H. B., The, Westfield, Mass.

Milvaco—Air eliminators, floats, strainers, traps, valves. Milwaukee Valve Co., Milwaukee, Wis.

Milwaukee—Heaters. Blower Application Co., Milwaukee, Wis.

Minfelt—Insulation. Mitchell & Smith, Inc., Detroit, Mich.

Miracle Air—Window ventilator units. Reliable Sheet Metal Engineering Co., Chicago, Ill.

Mir-O-Meter—Combustion control systems. Bowser & Co., Inc., S. F., Fort Wayne, Ind.

Mirro-Matic—Heaters. Handley Brown Heater Co., Jackson, Mich.

Mirro-Shell—Heaters. Handley Brown Heater Co., Jackson, Mich.

MKayO — Boilers. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Mobilene — Gaskets. Johns-Manville, New York, N. Y.

Moderator—Heating system. Warren Webster Co., Camden, N. J.

ModernAire—Fans, unit air conditioners. Dallas Engineering Co., Inc., Dallas, Tex.

Modustat — Valves. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Modutrol—Heating systems. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Modutron — Regulators. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Mogul—Packing. Johns-Manville, New York, N. Y.

Mogul—Boiler cleaning compounds and water treatment. North American Fibre Products Co., The, Cleveland, O.

Mohawk—Pipe. Cohoes Rolling Mill Co., Cohoes, N. Y.

Moisturator — Humidifiers. Russell & Co., W. A., Bridgeport, Conn.

Moncrief—Sheet metal pipe and fittings. Henry Furnace & Foundry Co., Cleveland, O.

Moncrief Hi-Capacity—Furnaces. Henry Furnace & Foundry Co., Cleveland, O.

Mongol—Pipe joint cement and compounds. Baer Bros., New York, N. Y.

Monobloc—Centrifugal pumps. — Worthington Pump & Machinery Corp., Harrison, N. J.

Mono-Block — Insulation. Baldwin-Hill Co., Trenton, N. J.

Mono-Cast—Pipe. American Cast Iron Pipe Co., Birmingham, Ala.

Monoflo—Hot water heating systems and fittings. Bell & Gossett Co., Morton Grove, Ill.

Monsoon—Fans, grilles, louvers. Jamieson Mfg. Co., Dallas, Tex.

Morflex — Flexible couplings. Morse Chain Co., Ithaca, N. Y.

Mortairset — Refractories. Walsh Refractories Corp., St. Louis, Mo.

Mortex—Insulation. Mortell Co., J. W., Kankakee, Ill.

Mosher—Separators. Barrett Machine Co., N. S., Pittsburgh, Pa.

Motoco—Gages, gage glasses, recorders, thermometers. Electric Auto-Lite Co., Motor Meter Gauge & Equipment Div., La Crosse, Wis.

Moto-Merco—Relays. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Motopump—Pumps. Yeomans Bros. Co., Chicago, Ill.

MotoReducer—Speed reducers. Philadelphia Gear Works, Inc., Philadelphia, Pa.

Motorstokor—Stokers. Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.

Motosteel—Valves. Taylor Instrument Companies, Rochester, N. Y.

Mototurb—Ventilators. Uno Ventilator Co., Cliftondale, Mass.

Muffletone—Insulation. Celotex Corp., The, Chicago, Ill.

Mullitex—Refractories. Walsh Refractories Corp., St. Louis, Mo.

Multiclone—Dust collectors. Western Precipitation Corp., Los Angeles, Cal.

Multiduty—Pulleys and sheaves. Gates Rubber Co., The, Denver, Colo.

Multifin—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Multi-Panel—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Multiport—Valves. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Multiseal—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Multitherm—Air conditioning units. Clarage Fan Co., Kalamazoo, Mich.

Multi-V—V belts. Goodrich Co., B. F., Akron, O.

Multivane—Fans, blowers, unit heaters. B. F. Sturtevant Co., Boston, Mass.

Multi-Wash—Dust collectors. Schneible Co., Claude B., Chicago, Ill.

Murco—Unit heaters. Murray Mfg. Co., D. J., Wausau, Wis.

Murex—Welding electrodes. Metal & Thermit Corp., New York, N. Y.

Murray—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

N-M-D — Valves. Lunkenheimer Co., Cincinnati, O.

NYBCo Steelfin—Heating surface. New York Blower Co., Chicago, Ill.

Nalco — Boiler cleaning compounds, water treatment. National Aluminate Corp., Chicago, Ill.

National—Fans, furnaces, heaters. Magirl Foundry & Furnace Works, P. H., Bloomington, Ill.

National—Pumps. Austin-Mason Co., New York, N. Y.

Naturzone—Insulation. Wilson & Co., Chicago, Ill.

Nelson—Pumps. Haering Co., Inc., D. W., Chicago, Ill.

Nelson—Stokers. Heating Assurance, Inc., Spokane, Wash.

Nemo—Insulating cement. Smith & Kanzler Corp., Elizabeth, N. J.

Neverust—Exhaust heads. Straight Line Foundry & Machine Corp., Direct Separator Div., Syracuse, N. Y.

New Cyclone—Dust collectors. Kirk & Blum Mfg. Co., Cincinnati, O.

New Kathode — Electrodes. Lincoln Electric Co., Cleveland, O.

New Lightweld — Electrodes. Lincoln Electric Co., Cleveland, O.

Newarc—Welding electrodes. Electric Arc, Inc., Newark, N. J.

Niagara—Meters, strainers. Buffalo Meter Co., Buffalo, N. Y.

Nibco—Fittings, heads, joints, nozzles, valves. Northern Indiana Brass Co., Elkhart, Ind.

Ni-Resist — Pipe. Walworth Co., New York, N. Y.

No-Drip—Insulation. Mortell Co., J. W., Kankakee, Ill.

No-Grip—Shears. Wiss & Sons Co., J., Newark, N. J.

Non-clog—Sewage ejectors. Chicago Pump Co., Chicago, Ill.

Non-Clog—Pipe line strainers. Boylston Steam Specialty Co., Chicago, Ill.

Non-Clogging—Spray nozzles. Link-Belt Co., Chicago, Ill.

Non-Con-Dux—Cement, insulation. Wilson, Inc., Grant, Chicago, Ill.

Non-Flash—Brazing torches, welding and cutting apparatus. Torchweld Equipment Div., National Cylinder Gas Co., Chicago, Ill.

Non-Frost — Insulation. Keasbey & Mattison Co., Ambler, Pa.

Non-Sweat — Insulation. Keasbey & Mattison Co., Ambler, Pa.

No-Ox-Id—Protective coatings. Dearborn Chemical Co., Chicago, Ill.

Norblo—Dust collectors, fans, washers. Northern Blower Co., Cleveland, O.

Nordstrom—Valves. Merco-Nordstrom Valve Co., Pittsburgh, Pa.

Northern Wool — Insulation. Northern Steel and Stoker Corp., Peoria, Ill.

Northwind—Unit air coolers. Pleasantaire Corp., Washington, D. C.

Norwesco—Cement and compounds, boiler and radiator sealing compounds. Atlas Chemical Co., Marietta, O.

No-Site—Louvers and shutters. Waterloo Register Co., Waterloo, Ia.

No Streak—Registers. Rock Island Register Co., Rock Island, Ill.

No-Ve-U—Door ventilators. Waterloo Register Co., Waterloo, Ia.

Novoid—Insulation. Cork Import Corp., New York, N. Y.

Novus—Boilers. National Radiator Co., The, Johnstown, Pa.

Nu-Air—Air conditioning units. American Metal Products Co., Fort Worth, Texas.

Nu-Air—Fans. Meier Electric & Machine Co., Indianapolis, Ind.

Nu-Air—Ventilators. Milcor Steel Co., Milwaukee, Wis.

Nu-Alpina—Ventilators. Milcor Steel Co., Milwaukee, Wis.

Nu-Notch — Mushroom ventilators. Knowles Mushroom Ventilator Co., Montclair, N. J.

Nuvent—Ventilators. Aeolus Dickinson, Chicago, Ill.

Nu-Wood—Insulation. Wood Conversion Co., St. Paul, Minn.

OB—Motor starters, valves. Ohio Brass Co., Mansfield, O.

O-B Bulldog—Bolts. Ohio Brass Co., Mansfield, O.

O.E.F.—Preheaters, water heaters. Frank Heaters, Inc., Paterson, N. J.

OK—Motors. Marathon Electric Mfg. Corp., Wausau, Wis.

OK—Stocks and dies. Greenfield Tap & Die Corp., Greenfield, Mass.

OPW—Valves. Ohio Pattern Works & Foundry Co., Cincinnati, O.

Octopus — Belting. Manheim Mfg. & Belting Co., Manheim, Pa.

Ofeldt—Boilers, superheaters. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Oilbuster—Boiler cleaning compounds. Cannon Chemical Co., Everett, Mass.

Oil-Fifty—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Oil-O-Matic — Oil burners. Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

Okay Tred—Leather belting. Houghten & Co., E. F., Philadelphia, Pa.

Ol' Faithful—Humidifiers. Maid-O-Mist, Inc., Chicago, Ill.

One Venturi—Heating systems. Taco Heaters, Inc., New York, N. Y.

Oriflex—Valves. Dunham Co., C. A., Chicago, Ill.

Oswego—Cutters, punches, wrenches. International Nutyp Tool Co., Oswego, N. Y.

Ovaltube—Gas burners. Beck Engineering Combustion Kompany, St. Louis, Mo.

Oxford—Unions. Standard Union Co., New York, N. Y.

Oxweld—Welding rod, welding and cutting apparatus. Linde Air Products Co., The, New York, N. Y.

Ozite — Insulation. American Hair & Felt Co., Chicago, Ill.

PC — Air conditioning units. Buffalo Forge Co., Buffalo, N. Y.

PDQC — Pipe machines. Bignall & Keeler Machine Wks., Edwardsville, Ill.

P & H—Welding electrodes. Harnischfeger Corp., Milwaukee, Wis.

P & H—Hansen—Arc Welders. Harnischfeger Corp., Milwaukee, Wis.

P. I. V. Gear—Speed changers. Link-Belt Co., Philadelphia, Pa.

Paintgrip — Sheets. American Rolling Mill Co., The, Middletown, O.

Palco—Packing. Greene, Tweed & Co., New York, N. Y.

Palco Wool-Saferized—Insulation. Pacific Lumber Co., The, San Francisco, Cal.

Palmaire—Unit heaters. Palmer Mfg. Corp., Phoenix, Ariz.

Palmetto—Packing. Greene, Tweed & Co., New York, N. Y.

Palmetto Supersheat — Gaskets and packing. Greene, Tweed & Co., New York, N. Y.

Par — Condensing units. Lynch Mfg. Corp., Defiance, O.

Paracoil — Heaters, preheaters, steam traps. Davis Engineering Corp., Elizabeth, N. J.

Paraline—Motor bases. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Parasol—Spray nozzles. Spraying Systems Co., Chicago, Ill.

Parko—Psychrometers. Parks-Cramer Co., Fitchburg, Mass.

Pathfinder—Belting. Goodyear Tire & Rubber Co., Akron, O.

Pax-Tite—Leather packing. Watson-Stillman Co., Roselle, N. J.

Pebco—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Peer—Welders. Pier Equipment Mfg. Co., Benton Harbor, Mich.

Peerless—Dust collectors, humidifiers, air washers. New York Blower Co., Chicago, Ill.

Peerless—Pipe machines. Bignall & Keeler Machine Works, Edwardsville, Ill.

Penco—Plastic fittings, pipe and tubing. North Penn Co., New York, N. Y.

Penn-M-Co—Fittings. Penn Mfg. Corp. of Washington, Pa., Washington, Pa.

Perfection—Plates. Beaton & Cadwell Mfg. Co., New Britain, Conn.

Permalined—Pipe. Jones & Laughlin Steel Corp., Pittsburgh, Pa.

Permanite—Packing. Keasbey & Mattison Co., Ambler, Pa.

Permat—Filters. Davies Air Filter Corp., New York, N. Y.

Petro—Oil burners, water heaters. Petroleum Heat & Power Co., Stamford, Conn.

Pexto — Brakes, punches, shears, wrenches. Peck, Stow & Wilcox Co., Southington, Conn.

Phantom Doorman—Door controls. Yale & Towne Mfg. Co., Stamford, Conn.

Pierce-Firebox — Boilers. Ames Iron Works, Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Pipe Master—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Pipemaster—Wrenches. Erie Tool Wks., Erie, Pa.

Pitco—Unions. Pittsburgh Valve & Fittings Corp., Barberton, O.

Pittsburgh—Radiators, unit heaters. Automatic Gas Equipment Co., Pittsburgh, Pa.

Pittsburgh-National—Meters. Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Plandaire—Air diffusers. Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.

Plasti-Calk—Caulking compounds. Chamberlin Metal Weather Strip Co., Detroit, Mich.

Plastiseal—Cement and Compounds. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Plastite—Caulking compounds. U. S. Stoneware Co., New York, N. Y.

Plastoid—Caulking compounds, furnace cement. Plastic Products Co., Detroit, Mich.

Playford—Stokers. Rosedale Foundry & Machine Co., Pittsburgh, Pa.

Plexifin—Unit heaters. Bayley Blower Co., Milwaukee, Wis.

Plexiform—Fans. Bayley Blower Co., Milwaukee, Wis.

Plumrite—Pipe. Bridgeport Brass Co., Bridgeport, Conn.

Plymco—Air filters. Plymouth Cordage Co., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass. National Sales Agents.

Plymouth—Stokers. Clizbe Bros. Mfg. Co., Plymouth, Ind.

Poeco—Insulation. Poe Co., C. W., Cleveland, O.

Polartron—Relays, regulators, switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Popular—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Porex—Pipe line filters. General Motors Corp., Moraine Products Div., Dayton, O.

Porto-Power—Pipe benders. Blackhawk Mfg. Co., Milwaukee, Wis.

Pottstown—Pumps. Allen Billmyre Corp., Mamaroneck, N. Y.

Power—Belting. Rhoads & Sons, J. E. Philadelphia, Pa.

Power Boy—Pipe cutting and threading machines. Oster Mfg. Co., Cleveland, O.

Power-Flex—Stokers. Link-Belt Co., Chicago, Ill.

Power Pak—Boilers. Orr & Sembower, Inc., Reading, Pa.

Precipitron—Air cleaners. Westinghouse Electric & Mfg. Co., Cleveland, O.

Premier—Boilers, heaters. National Radiator, Co., The, Johnstown, Pa.

Premier—Welding rod. American Steel & Wire Co., Cleveland, O.

Pressuretrol—Regulators, switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Prestal—Pipe benders. Tal's Prestal Bender, Inc., Milwaukee, Wis.

Prest-O-Lite—Leak detectors, torches. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Prest-O-Weld—Welding and cutting apparatus. Linde Air Products Co., The, New York, N. Y.

Princo—Anemometers, gages, hygrometers, manometers, psychrometers, regulators, relays, thermometers, thermostats. Precision Thermometer & Instrument Co., Philadelphia, Pa.

Probestos—Gasket. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Protectomotor—Air filters. Staynew Filter Corp., Rochester, N. Y.

Protectorelay—Relays. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Protectoring—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Proxlin—Enamels and lacquers. Acme White Lead & Color Works, Detroit, Mich.

Pryzoak—Belting. Graton & Knight Co., Worcester, Mass.

Pulling—Circulators, pumps. Columbus Steam Pump Works Co., Columbus, O.

Pulverzone—Stokers. American Coal Burner Co., Chicago, Ill.

Punkah—Louvers and shutters. Kelvin-White Co., Boston, Mass.

Purox—Electrodes, welding and cutting apparatus. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Pyralux—Enamels and lacquers. du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.

Pyrex—Glass pipe, gage and sight glasses, nozzles. Corning Glass Wks., Corning, N. Y.

Pyro—Thermometers, recorders, regulators. Pyrometer Instrument Co., New York, N. Y.

Pyrofelt—Insulation. Mitchell & Smith, Inc., Detroit, Mich.

Pyroment—Cement. Keasbey & Mattison Co., Ambler, Pa.

Pyrotron—Recorders. Bailey Meter Co., Cleveland, O.

Q-Chrome—Refractories. Quigley Co., Inc., New York, N. Y.

QD—Sheaves. Worthington Pump & Machinery Corp., Harrison, N. J.

Q-Seal—Caulking compounds. Quigley Co., Inc., New York, N. Y.

Q-T—Insulation. Celotex Corp., The, Chicago, Ill.

QT—Unit heaters. Kisco Boiler & Engineering Co., St. Louis, Mo.

Quad—Cooling towers. Young Radiator Co., Racine, Wis.

Quartzoid—Sprinkler heads. Grinnell Co., Inc., Providence, R. I.

Quiet May—Oil burners. May Oil Burner Corp., Baltimore, Md.

Quiet-Seal—Convection type radiation. Modine Mfg. Co., Racine, Wis.

Quiet Zone—Blower wheels, fans. Palmer's Mfg. Corp., Phoenix, Ariz.

Quilt—Insulation. Cabot, Inc., Samuel, Boston, Mass.

Quintuplet—Valves. Maid-O-Mist, Inc., Chicago, Ill.

RB—Couplings. Link-Belt Co., Indianapolis, Ind.

RBC—Roller bearings. Roller Bearing Co. of America, Trenton, N. J.

RB Pressure—Pressure blowers. Western Blower Co., Seattle, Wash.

R & G—Grilles, registers. Register & Grille Mfg. Co., Brooklyn, N. Y.

R-K—Combustion control systems, regulators, valves. Ruggles-Klingemann Mfg. Co., Salem, Mass.

R & M—Motors. Robbins & Myers, Inc., Springfield, O.

R & M Moyno—Pumps. Robbins & Myers, Inc., Springfield, O.

R-P Zeolite—Water treatment. Research Products Corp., Madison, Wis.

R. P. & C.—Fittings, valves. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.

R-U-F—Fans. Reed Unit-Fans, Inc., New Orleans, La.

R-Z-U—Boilers. Fitzgibbons Boiler Co., Inc., New York, N. Y.

Race—Fans, heaters. Royal Air Conditioning Equipment Co., Alhambra, Cal.

Racine—Time switches. Reliance Automatic Lighting Co., Racine, Wis.

Radialflow—Valves. Smolensky Valve Co., Inc., Cleveland, O.

Radiatherm—Valves. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Radi-Ion—Ionization apparatus. Montgomery Bros., San Francisco, Cal.

Radolite—Cement, refractories. Pyrolite Products Co., Cleveland, O.

Raintite—Ventilators. Aeolus Dickinson, Chicago, Ill.

Rajah—Packing. Johns-Manville, New York, N. Y.

Ranarex—Analyzers, indicators, recorders. Permutit Co., New York, N. Y.

Rapid—Oil coolers. Bell & Gossett Co., Morton Grove, Ill.

Rapiduction—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Rawl-Anchor—Bolts. Rawlplug Co., Inc., The, New York, N. Y.

Rawls—Bolts. **Rawlplug Co., Inc., The, New York, N. Y.**

Raybould—Couplings. Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Raydiant—Radiation. Weil-McLain Co., Chicago, Ill.

Reco—Air conditioning units. Refrigeration Economics Co., Inc., Canton, O.

Reco—Accumulators, condensers, headers, heaters, preheaters, tanks, unit coolers. Richmond Engineering Co., Richmond, Va.

Reco—Controllers and starters, motors. Reynolds Electric Co., Chicago, Ill.

Reco Radi-Aire—Fans. Reynolds Electric Co., Chicago, Ill.

Record-O-Stat—Recorder-Controllers. Johnson Service Co., Milwaukee, Wis.

Recoy—Chillers, condensers, cooling surface, unit coolers. Refrigeration Economics Co., Inc., Canton, O.

Red—Operators, regulators, switches, valves. Cooper Co., Clark, Palmyra, N. J.

Red Devil—Cement. Pecora Paint Co., Philadelphia, Pa.

Red Diamond—Pipe. American District Steam Co., North Tonawanda, N. Y.

Red Flash—Traps. Ellis Drier Co., Chicago, Ill.

Red Head—Tongs. Billings & Spencer Co., Hartford, Conn.

Red Head—Traps. Ellis Drier Co., Chicago, Ill.

Red Top—Humidistats, thermostats. H-B Instrument Co., Philadelphia, Pa.

Redi—Stokers. General Machinery Co., Spokane, Wash.

Redi-Return—Pumps. American-Marsh Pumps, Inc., Battle Creek, Mich.

Redi-Vac—Pumps. American-Marsh Pumps, Inc., Battle Creek, Mich.

Refrak° Screen—Gas burners. Selas Co., The, Philadelphia, Pa.

Rego—Welding and cutting apparatus. Universal Power Corp., Cleveland. O.

Rego—Regulators, torches, welding and cutting apparatus. National Cylinder Gas Co., Chicago, Ill.

Relatrol—Heating systems. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Reliance—Packing. Chicago Belting Co., Chicago, Ill.

Reliance—Regulators. American Meter Co., Inc., New York, N. Y.

Reliance—Regulators. General Controls Co., Glendale, Cal.

Remco—Bases. Manley Products Corp., York, Pa.

Renewo—Valves. Lunkenheimer Co., Cincinnati, O.

Renu-Vent—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Research—Belting. Graton & Knight Co., Worcester, Mass.

Reverbolite—Insulation. Celotex Corp., The, Chicago, Ill.

Rex — Blower wheels, fans. Air Controls, Inc., Cleveland, O.

Rex—Chain drives, couplings, nozzles, pillow blocks, pumps. Chain Belt Co., Milwaukee, Wis.

Rex-AC—Bearings. Air Controls, Inc., Cleveland, O.

Rex-Airate—Roof ventilators, blower wheels. Air Controls, Inc., Cleveland, O.

Rex-Flex—Ducts, tubing. Chicago Metal Hose Corp., Maywood, Ill.

Rexoil—Burners, heaters. Reif-Rexoil, Inc., Buffalo, N. Y.

Rexvane—Fans. Sturtevant Co., B. F., Boston, Mass.

Rex-Weld—Hose. Chicago Metal Hose Corp., Maywood, Ill.

Reyn-O-Cell — Insulation. Reynolds Metals Co., Richmond, Va.

Rhino—Calking compounds. Pecora Paint Co., Philadelphia, Pa.

Richvar—Radiation. Richmond Radiator Co., Gas Products Div., Uniontown, Pa.

Ridgid—Pipe machines, wrenches, cutters, vises. Ridge Tool Co., Elyria, O.

Rifco—Unions. Rhode Island Fittings Co., Hillsgrove, R. I.

Rihco—Humidifiers. Rhode Island Humidifier & Ventilating Co., Boston, Mass.

Rip-Clean—Filters. Research Products Corp., Madison, Wis.

Rip-pl—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Rocan—Copper sheets. Revere Copper and Brass, Incorporated, New York, N. Y.

Rocktex—Insulation. Carey Mfg. Co., Philip, Lockland, Cincinnati, O.

Rocop—Heaters. Rome-Turney Radiator Co., Rome, N. Y.

Rodpax—Packing. National Engineering Products, Inc., Washington, D. C.

Ro-Flo — Compressors. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Roman Bronze — Welding rod. Revere Copper and Brass Incorporated, New York, N. Y.

Roofloy — Lead sheets. Revere Copper and Brass Incorporated, New York, N. Y.

Roofvane—Ventilators. Sturtevant Co., B. F., Boston, Mass.

Roof-Vent—Ventilators. Reed Unit-Fans, Inc., New Orleans, La.

Rotameter—Flow meters. Schutte & Koerting Co., Philadelphia, Pa.

Rota-Roll — Pumps. Sundstrand Machine Tool Co., Rockford, Ill.

Roto Blast—Furnaces. Moncrief Furnace Co., Atlanta, Ga.

Roto-Clone—Dust collectors. American Air Filter Co., Inc., Louisville, Ky.

Rotohood—Uno Ventilator Co., Cliftondale, Mass.

Rotojet—Spray nozzles. Binks Mfg. Co., Chicago, Ill.

Roxite—Pipe. United States Stoneware Co., New York, N. Y.

Rubalt—Enamels and lacquers. Hague & Co., Inc., Alfred, Brooklyn, N. Y.

Rubyfluid—Solder. Ruby Chemical Co., Columbus, O.

Runwel—Packing. Greene, Tweed & Co., New York, N. Y.

Rusco—Insulation. Russell Co., F. C., Cleveland, O.

Rustbuster—Cleaning compounds. Cannon Chemical Co., Everett, Mass.

S-A—Feeders. Stephens-Adamson Mfg. Co., Aurora, Ill.

SA—Valves. Lunkenheimer Co., Cincinnati, O.

S. C.—Air heaters, gas burners. Surface Combustion, Toledo, O.

S-N—Water heaters. Scott-Newcomb, Inc., St. Louis, Mo.

S & P—Burners, governors, preheaters, regulators, strainers, valves. Staples & Pfeiffer, Ltd., San Francisco, Cal.

S. R. P.—Protective coatings. Sonneborn Sons, Inc., L., New York, N. Y.

Saf-Dry—Refrigerants. Liquid Carbonic Corp., The, Chicago, Ill.

Sal-Mo—Cement, insulation, packing. Sall Mountain Co., Chicago, Ill.

Sanidaire—Humidifiers. U. S. Air Conditioning Corp., Minneapolis, Minn.

Santosite—Water treatment. Monsanto Chemical Co., St. Louis, Mo.

Santrol—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Saran—Plastic pipe and tubing. Acadia Synthetic Products Div., Western Felt Works, Chicago, Ill.

Saran—Plastic pipe and tubing. Dow Chemical Co., Midland, Mich.

Saran — Plastic fittings and tubing. Hodgman Rubber Co., Framingham, Mass.

Saran — Plastic tubing. Skuttle Mfg. Co., Detroit, Mich.

Saunders—Pipe cutters. Erie Tool Works, Erie, Pa.

Sauter—Time switches. Cramer Co., Inc., R. W., The, Centerbrook, Conn.

Schwan—Gas burners. Jamieson Mfg. Co., Dallas, Texas.

Scotch Giant—Refrigerating compressors. General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.

Scroll-Pivoter—Shears. Wiss & Sons Co., J., Newark, N. J.

Scru-peller—Ejectors. Chicago Pump Co., Chicago, Ill.

Sea Lion—Packing. Chicago Belting Co., Chicago, Ill.

Seal Cote—Enamels and lacquers. Fales Chemical Co., Inc., The, New York, N. Y.

Seal Master—Bearings. Stephens-Adamson Mfg. Co., Aurora, Ill.

Sealkote—Cement. Keasbey & Mattison Co., Ambler, Pa.

Seal-Less — Compressors. Westinghouse Electric & Mfg. Co., Springfield, Mass.

Seal-Rite—Cement and compounds. Macksons Co., New York, N. Y.

Seigelite — Gaskets. Johns-Manville, New York, N. Y.

Seismo-Dampers—Bases. Korfund Co., Long Island City, N. Y.

Sells—Bearings. Royersford Foundry & Machine Co., Royersford, Pa.

Sensatherm — Thermostats. Mercoid Corp., Chicago, Ill.

Sensitrol—Relays. Weston Electrical Instrument Corp., Newark, N. J.

Sentinel—Pumps. Red Jacket Mfg. Co., Davenport, Ia.

Sentry—Smoke alarms. Boiler Room Equipment, Inc., New York, N. Y.

Serrabestos—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Service—Packing. Johns-Manville, New York, N. Y.

Sesure—Gages. Yarnall-Waring Co., Philadelphia, Pa.

"77"—Pipe covering. Eagle-Picher Lead Co., Cincinnati, O.

"78"—Traps. Webster & Co., Warren, Camden, N. J.

Shawco—Bends, headers. Shaw Co., Benjamin F., Wilmington, Del.

Shelby—Tubing. National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.

Shield-Arc — Electrodes, arc welders. Lincoln Electric Co., Cleveland, O.

Shock Pads—Bases and pads. Butterworth, Jr., B. T., New Canaan, Conn.

Shut-O-Vent—Louvers and shutters. Reed Unit-Fans, Inc., New Orleans, La.

Silent Air—Fans. Belanger Fan & Blower Co., Detroit, Mich.

Silentaire — Window ventilator units. Berger Mfg. Div., Republic Steel Corp., Canton, O.

Silentblu—Gas burners. Beck Engineering Combustion Kompany, St. Louis, Mo.

Silentvane—Fans. Sturtevant Co., B. F., Boston, Mass.

Sil-Fos—Solder. Handy & Harman, New York, N. Y.

Silicair—Insulation. Western Silicair Products, Inc., Burbank, Cal.

Silverlink—Chain drives. Link-Belt Co., Indianapolis, Ind.

Silverseal—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Silverstreak—Chain drive. Link-Belt Co., Indianapolis, Ind.

Silvertop—Eliminators, traps. Anderson Co., V. D., The, Cleveland, O.

Simplex—Gages. Viking Pump Co., Cedar Falls, Ia.

Simplex—Pipe vises. Desmond-Stephan Mfg. Co., Urbana, O.

Simplex — Regulators, tanks. Bell & Gossett Co., Morton Grove, Ill.

Sirocco—Blowers, dust collectors, fans, unit air conditioners, unit air coolers, unit air humidifiers, air washers. American Blower Corp., Detroit, Mich.

Skil Drill—Drills. Skilsaw, Inc., Chicago, Ill.

Slugin—Bolts. Star Expansion Bolt Co., New York, N. Y.

Smith-Midget—Direct radiation. Smith Co., Inc., H. B., Westfield, Mass.

Smith-Mills — Boilers. Smith Co., Inc., H. B., Westfield, Mass.

Smoot—Combustion control systems, regulators. Republic Flow Meters Co., Chicago, Ill.

Snapin — Bolts. Star Expansion Bolt Co., New York, N. Y.

Sno-Breze — Air conditioning units, cooling surface. Palmer Mfg. Corp., Phoenix, Ariz.

Softweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Solray—Radiation. Weil-McLain Co., Chicago, Ill.

Sono-O-Seal—Insulation. General Insulating Products Co., Brooklyn, N. Y.

Soundliner — Insulation. Baldwin-Hill Co., Trenton, N. J.

Sovereign—Packing. Darcoid Co., Inc., New York, N. Y.

Spatter Film—Electrodes. Lincoln Electric Co., Cleveland, O.

Special X—Solder. Industrial Service Laboratories, Milwaukee, Wis.

Speed Heater—Unit heaters. Sturtevant Co., B. F., Boston, Mass.

Speedarc—Electrodes. Universal Power Corp., Cleveland, O.

Sphero—Plug valves. Fairbanks Co., New York, N. Y.

Spider Web—Air filters. Wilson & Co., Chicago, Ill.

Spiralwound—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Spirodome — Spray nozzles. Cooling Tower Co., Inc., The, Div. of the Fluor Corp., Ltd., New York, N. Y.

Spirotallic — Gaskets. Johns-Manville, New York, N. Y.

Spirovane—Fans. Western Blower Co., Seattle, Wash.

Sporlan—Valves. Spoehrer-Lange Co., St. Louis, Mo.

Spraco—Nozzles, separators, strainers, washers. Spray Engineering Co., Somerville, Mass.

Spra-Rite—Nozzles. Binks Mfg. Co., Chicago, Ill.

Spray-Acoustic—Insulation. Sprayo-Flake Co., Chicago, Ill.

Springin—Bolts. Star Expansion Bolt Co., New York, N. Y.

Stabilflo—Valves. Foxboro Co., Foxboro, Mass.

Stable-Arc—Electrodes, arc welders. Lincoln Electric Co., Cleveland, O.

Stacon—Regulators, valves. Edison, Inc., Thomas A., Instrument Div., West Orange, N. J.

Staldarc—Electrodes. Universal Power Corp., Cleveland, O.

Stainarc—Electrodes. Universal Power Corp., Cleveland, O.

Stainless—Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Stainweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Standard — Convection type radiation. Modine Mfg. Co., Racine, Wis.

Standforated—Grilles. Standard Stamping & Perforating Co., Chicago, Ill.

Star—Ventilators. Merchant & Evans Co., Philadelphia, Pa.

Stazin—Bolts. Star Expansion Bolt Co., New York, N. Y.

Steelok—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Sterilamp—Lamps. Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

Sterlco — Controls, eliminators, floats, pumps, strainers, heating systems, traps, valves. Sterling, Inc., Milwaukee, Wis.

Sterling — Compressors, condensers, valves. Reynolds Mfg. Co., Inc., Springfield, Mo.

Stictite—Cement. Refractory & Insulation Corp., New York, N. Y.

Stokerator—Stokers. Northern Steel & Stoker Corp., Peoria, Ill.

Stokerelay—Relays. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Stokol—Stokers, water heaters. Schwitzer-Cummins Co., Indianapolis, Ind.

Streamaire—Unit heaters, radiation, cooling surface. Young Radiator Co., Racine, Wis.

Stronghold—Belting. Rhoads & Sons, J. E., Philadelphia, Pa.

Stud-Pak—Insulation. United States Mineral Wool Co., Chicago, Ill.

Sullarc—Electrodes. Universal Power Corp., Cleveland, O.

Sunray — Boilers, radiation. United States Radiator Corp., Detroit, Mich.

Super Air Screws—Fans. Marathon Electric Mfg. Corp., Wausau, Wis.

Super Cold Fin—Cooling surface. Rempe Co., Chicago, Ill.

Super Seal—Fittings. Grinnell Co., Inc., Providence, R. I.

Super "66" — Insulation. Eagle-Picher Lead Co., Cincinnati, O.

Super 7—V belts. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Super Silvertop—Traps. Anderson Co., V. D., The, Cleveland, O.

Super X—Copper sheets. Western Cartridge Co., Brass Mill Div., East Alton, Ill.

Supercord—V belts. Browning Mfg. Co., Inc., Maysville, Ky.

Supercutno—Packing. Greene, Tweed & Co., New York, N. Y.

Super-deLavaud—Pipe. U. S. Pipe & Foundry Co., Burlington, N. J.

Superector—Wrenches. Williams & Co. J. H., Buffalo, N. Y.

Super-Fan—Fan blades. Norwin Co., Freeport, Ill.

Superflex — Drives. Gates Rubber Co., The, Denver, Colo.

Superheat—Gas burners. Selas Co., The, Philadelphia, Pa.

Superheat—Packing, Keasbey & Mattison Co., Ambler, Pa.

Superior—Fans. American Foundry & Furnace Co., Bloomington, Ill.

Superior — Wrenches. Williams & Co. J. H., Buffalo, N. Y.

Superratchet—Ratchet Wrenches. Williams & Co., J. H., Buffalo, N. Y.

Superrench—Wrenches. Williams & Co. J. H., Buffalo, N. Y.

Super-S—Gages. Klingerit, Inc., New York, N. Y.

Supersocket—Wrenches. Williams & Co., J. H., Buffalo, N. Y.

Supertemp — Insulation. Eagle-Picher Lead Co., Cincinnati, O.

Supertherm—Systems. Ross Engineering Corp., J. O., New York, N. Y.

Sure Hot — Heaters. Little Mfg. Co., M. S., Hartford, Conn.

Sure Return — Condensation return pumps. Chicago Pump Co., Chicago, Ill.

Sure Seal — Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Surevent—Valves. Gorton Heating Corp., Cranford, N. J.

Sureweld—Electrodes. National Cylinder Gas Co., Chicago, Ill.

Surlock—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Sweet's—Exhaust heads. Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.

Sylphon — Bellows, joints, operators, regulators, valves. Fulton Sylphon Co., Knoxville, Tenn.

Sylphon—Traps, valves. Webster & Co., Warren, Camden, N. J.

Synchro-Meter—Meters. Bailey Meter Co., Cleveland, O.

Synchrotie—Recorders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Syncretizer—Unit ventilators. Nesbitt, Inc., John J., Philadelphia, Pa.

T.T.—Smoke guns. Hill, E. Vernon, Chicago, Ill.

Tabasco — Water heaters. Kewanee Boiler Corp., Kewanee, Ill.

Tag—Humidistats, hygrometers, manometers, meters, psychrometers, recorders, regulators, thermometers, traps, valves. Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.

Tampico—Air filters. Chicago Filter Co., Joliet, Ill.

Tampin — Bolts. Star Expansion Bolt Co., New York, N. Y.

Tanktrol—Regulators. Automatic Control Co., St. Paul, Minn.

Tannate—Belting, packing. Rhoads & Sons, J. E., Philadelphia, Pa.

Tanseal—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Techni-Louvre—Vanes. Waterloo Register Co., Waterloo, Ia.

Techni-Trol—Dampers. Waterloo Register Co., Waterloo, Ia.

Techni-Turn—Vanes. Waterloo Register Co., Waterloo, Ia.

Teksag Colloid—Boiler compounds. American Teksag Products Co., Inc., Mount Vernon, N. Y.

Televisor—Gages. Schutte & Koerting Co., Philadelphia, Pa.

Tellevel—Switches. Stephens-Adamson Mfg. Co., Aurora, Ill.

Teltru—Anemometers, gages. Hill, E. Vernon, Chicago, Ill.

Tem-Clock (Electric)—Time switches. Penn Electric Switch Co., Goshen, Ind.

Temlok—Insulation. Armstrong Cork Co., Lancaster, Pa.

Temperator — Unit air conditioners. Dunham Co., C. A., Chicago, Ill.

Tempryte — Windows. Truscon Steel Co., Youngstown, O.

Temtrol — Thermostats. Penn Electric Switch Co., Goshen, Ind.

Texrope—V-belt drives, pulleys, v-belts. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Tharco—Cement. The Armstrong Co., Detroit, Mich.

Thawzone—Dehydrant and acid neutralizer. Highside Chemicals Co., Newark, N. J.

Therhumiter—Thermometers. Weksler Thermometer Corp., New York, N. Y.

Thermair—Furnaces, heaters. New York Blower Co., Chicago, Ill.

Thermalfin—Unit coolers. Thermal Co., Inc., Milwaukee, Wis.

Thermalfuel—Furnaces. Beck Engineering Combustion Kompany, St. Louis, Mo.

Therm-A-Lute — Cement and compounds. Superior Valve & Fittings Co., Pittsburgh, Pa.

Thermascrete—Refractories. Munn and Steele, Inc., Newark, N. J.

Thermax—Insulation. Celotex Corp., The, Chicago, Ill.

Thermek—Heating and cooling surface. Peerless of America, Inc., Chicago, Ill.

Thermidaire—Burners, furnaces, heaters. Campbell Heating Co., E. K., Kansas City, Mo.

Thermix—Dust collector. Prat-Daniel Corp., Port Chester, N. Y.

Thermo—Expansion valves. Alco Valve Co., St. Louis, Mo.

Thermo—Heaters. American Furnace Co., St. Louis, Mo.

Thermochek—Controls. Bell & Gossett Co., Morton Grove, Ill.

Thermofin — Radiation. Grinnell Co., Inc., Providence, R. I.

Thermoflex—Strainers, heating systems, traps, valves. Cashin Co., W. D., Boston, Mass.

Thermoflo—Valves. Bell & Gossett Co., Morton Grove, Ill.

Thermogas—Furnaces. Beck Engineering Combustion Kompany, St. Louis, Mo.

Thermoguide—Thermometers. Taylor Instrument Companies, Rochester, N. Y.

Thermoil—Furnaces. Beck Engineering Combustion Kompany, St. Louis, Mo.

Thermolier—Unit heaters. Grinnell Co., Inc., Providence, R. I.

Thermopane—Windows. Libbey-Owens Ford Glass Co., Toledo, O.

Therm-o-tile—Conduit. Porter & Co., Inc., H. W., Newark, N. J.

Thermotrol—Valves. Sterling Engineering Co., Milwaukee, Wis.

Thermovent—Unit ventilators. Nesbitt, Inc., John J., Philadelphia, Pa.

Thermovoir — Water heaters. Bell & Gossett Co., Morton Grove, Ill.

Thin Man—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Thor—Belting. Goodyear Tire & Rubber Co., Akron, O.

Thor—Drills, pumps. Independent Pneumatic Tool Co., Chicago, Ill.

Thorobred—V belts and v belt drives. Dayton Rubber Mfg. Co., Dayton, Ohio.

Thredolets—Fittings. Bonney Forge & Tool Wks., Allentown, Pa.

Thrift—Switches. Tork Clock Co., Inc., Mt. Vernon, N. Y.

Throway—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Ti-Compact — Boilers. Titusville Iron Works Co., Titusville, Pa.

Ticone—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Tighton—Unions. Standard Union Co., New York, N. Y.

Timercoid—Time switches. Mercoid Corp., Chicago, Ill.

Timerelay—Relays. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Timetrol (Manual) — Time switches. Penn Electric Switch Co., Goshen, Ind.

Tin-Loy — Solder. Eagle-Picher Lead Co., Cincinnati, O.

Tiny—Traps. Nason Co., Detroit, Mich.

Tiscot—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Titan—Traps. Nason Co., Detroit, Mich.

Tite — Caulking compounds. Krehbiel Co., J. H., Chicago, Ill.

Tite Seal—Cement and compounds. Radiator Specialty Co., Charlotte, N. C.

Tom Thumb—Pipe machines. Oster Mfg. Co., Cleveland, O.

Toncan—Pipe, sheets. Republic Steel Corp., Cleveland, O.

Toncanarc—Electrodes. Universal Power Corp., Cleveland, O.

Toolweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Torkflash—Wrenches, Blackhawk Mfg. Co., Milwaukee, Wis.

Torqometer — Torque indicating wrenches. Snap-On Tools Corp., Kenosha, Wis.

Transite — Conduit, pipe, refractories, sheets and board. Johns-Manville, New York, N. Y.

Trans-Lux — Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Transweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Trap-Dri — Filters, strainers. Automatic Products Co., Milwaukee, Wis.

Tray—Cooling towers, condensers. New England Cooling Tower Co., Boston, Mass.

Treet-O-Control—Water treatment. % Proportioneers, Inc. %, Providence, R. I.

Treet-O-Unit—Pumps, % Proportioneers, Inc. %, Providence, R. I.

Trem-Bar—Insulation. United States Gypsum Co., Chicago, Ill.

Tri-Clad—Motors. General Electric Co.. Schenectady, N. Y.

Trident—Meters. Neptune Meter Co., New York, N. Y.

Trimo—Cutters, vises, wrenches. Trimont Mfg. Co., Boston, Mass.

Trimo—Cutters. Erie Tool Works, Erie, Pa.

Triple-A—Enamels and lacquers, protective coatings. Quigley Co., Inc., New York, N. Y.

Triple Duty—Boilers. Bass Foundry & Machine Co., Ft. Wayne, Ind.

Triple Duty—Heating systems. Bell & Gossett Co., Morton Grove, Ill.

Tripl-Mix—Cement. Krehbiel Co., J. H., Chicago, Ill.

Tri-Sil—Dampers. Tuttle & Bailey, Inc., New Britain, Conn.

Tri-trol—Regulator, switches, thermostats. Marsh Corp., Jas. P., Chicago, Ill.

Triumph—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Trojan—Boilers, Burnham Boiler Corp., Irvington, N. Y.

Truflex—Bi-metals. General Plate Div., Metals & Controls Corp., Attleboro, Mass.

Truliradiant — Gas burners. Sullivan Valve & Engineering Co., Butte, Mont.

Tube-Loy—Lead alloy tubing. American Smelting & Refining Co., New York, N. Y.

Tuf-flex — Gage and sight glasses. Libbey-Owens Ford Glass Co., Toledo, O.

Tuf-On—Protective coatings. Wipe-On Corp., New York, N. Y.

Tulox—Plastic pipe and tubing. Extruded Plastics, Inc., Norwalk, Conn.

Turbo—Air washers, spray nozzles. Bayley Blower Co., Milwaukee, Wis.

Turbo Vane—Fans and blowers. B. F. Sturtevant Co., Boston, Mass.

Turboflo — Convection type radiation. Modine Mfg. Co., Racine, Wis.

Turret — Pumps. Yeomans Bros. Co., Chicago, Ill.

Tuway—Strainers. Wright-Austin Co., Detroit, Mich.

20th Century—Bearings. Roller Bearing Co. of America, Trenton, N. J.

Twin Contact—Controls. Perfex Corp. (Controls Div.), Milwaukee, Wis.

Twin G-Fin — Preheaters. Griscom-Russell Co., The, New York, N. Y.

Two Way—Dampers. Tuttle & Bailey, Inc., New Britain, Conn.

Tygon — Protective coatings, plastic tubing. U. S. Stoneware Co., New York, N. Y.

Tymit—Switches. Tork Clock Co., Inc., Mt. Vernon, N. Y.

Type ME—Blower wheels, fans. New York Blower Co., Chicago, Ill.

Tytecote—Insulation. Specialty Converters, Inc., East Braintree, Mass.

UAC—Unit air conditioners. Burnham Boiler Corp., Irvington, N. Y.

U. F. S.—Clamps. Grinnell Co., Inc., Providence, R. I.

U. S.—Unions. United Superior Union Co., Inc., Brooklyn, N. Y.

USS—Sheets, structural shapes. Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

U. S. Airco—Air conditioning equipment, speed changers. U. S. Air Conditioning Corp., Minneapolis, Minn.

UTA—Pumps. American-Marsh Pumps, Inc., Battle Creek, Mich.

U-Loy—Sheets. Republic Steel Corp., Cleveland, O.

Unaflo — Steam engines. Ames Iron Works, Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Unarco—Insulation. Union Asbestos & Rubber Co., Cicero, Ill.

Unibestos—Insulation. Union Asbestos & Rubber Co., Cicero, Ill.

Unicoils—Air conditioning unit. Clarage Fan Co., Kalamazoo, Mich.

Unicool—Humidifiers, unit air conditioners, unit air humidifiers, air washers. Betz Unit Air Cooler Co., Kansas City, Mo.

Uni-fin—Grilles, registers. Barber-Colman Co., Rockford, Ill.

Uni-flo—Air diffusers, dampers, grilles. Barber-Colman Co., Rockford, Ill.

Uniplastic—Furnace and insulating cement. Robinson Insulation Co., Great Falls, Mont.

Unisorb—Bases and pads, insulation. Felters Co., Inc., Boston, Mass.

Unitaire—Unit air conditioners. Westinghouse Electric & Mfg. Co., Springfield, Mass.

Unitem—Heaters. Bell & Gossett Co., Morton Grove, Ill.

Unitherm—Unit heaters and coolers. Clarage Fan Co., Kalamazoo, Mich.

Unitrol—Regulators, switches, thermostats. Marsh Tritrol Co., Chicago, Ill.

Universal—Benders. Hossfeld Mfg. Co., Winona, Minn.

Universal—Air filters. Hugo Mfg. Co. West Duluth, Minn.

Universal — Cast iron pipe. Central Foundry Co., New York, N. Y.

Universal—Centrifugal pumps. Bell & Gossett Co., Morton Grove, Ill.

Universal—Gages. Rochester Mfg. Co., Inc., Rochester, N. Y.

Universal—Gas and oil burners. Mettler Co., Lee B., Los Angeles, Cal.

Universal — Packing. Johns-Manville, New York, N. Y.

Universal—Regulators. Dockson Corp., Detroit, Mich.

Universal—Vibration eliminators. Butterworth, B. T., Jr., New Canaan, Conn.

Upson—Bolts and studs. Republic Steel Corp., Bolt & Nut Div., Cleveland, O.

Utica—Radiation. International Heater Co., Utica, N. Y.

Utility -- Compressors. Schramm, Inc., West Chester, Pa.

Utility—Packing. Keasbey & Mattison Co., Ambler, Pa.

Utilus—Fans. Hirschman Co., W. F., Buffalo, N. Y.

Vacu-Draft—Blowers. Muncie Gear Wks., Inc., Muncie, Ind.

Vacuumstat — Switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Valcalox—Damper regulators. Young Regulator Co., Cleveland, O.

Valpit—Unions. Pittsburgh Valve & Fittings Corp., Barberton, O.

Vapor-seal—Insulation. Celotex Corp., The, Chicago, Ill.

Vaporstat—Switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Varipitch—Pulleys and sheaves. Gates Rubber Co., The, Denver, Colo.

Vari-Pitch—Speed changers. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Veelos—V-belts. Manheim Mfg. & Belting Co., Manheim, Pa.

Velometer—Air velocity meters. Illinois Testing Laboratories, Inc., Chicago, Ill.

Velvet—Cement. Keasbey & Mattison Co., Ambler, Pa.

Vent-Vac—Heating systems. Anderson Products, Inc., Cambridge, Mass.

Ventil-aire—Window ventilator and filter units. Fairbanks, Morse & Co., Chicago, Ill.

Vento — Heating surface. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Vento—Traps. Haines & Co., William S., Philadelphia, Pa.

Vent-Rite—Air valves, air eliminators. Anderson Products, Inc., Cambridge, Mass.

Ventura—Fans. American Blower Corp., Detroit, Mich.

Venturafin—Unit heaters. American Blower Corp., Detroit, Mich.

Venturi — Fan housings. Commercial Shearing & Stamping Co., Youngstown, O.

Venturi — Meters. Builders-Providence, Inc., Div. of Builders Iron Foundry, Providence, R. I.

Venturi-Flo—Air diffusers. Barber-Colman Co., Rockford, Ill.

Verco—Insulating cement. Nelson Mfg. Co., B. F., Minneapolis, Minn.

Vermiculite — Insulation. International Vermiculite Co., Springfield, Ill.

Vernier-Set—Time switches. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Vertiflow—Unit heaters. Young Radiator Co., Racine, Wis.

Vertivent—Ventilators. Young Radiator Co., Racine, Wis.

V-Flat—Pulleys and sheaves. Dayton Rubber Mfg. Co., Dayton, O.

Vibracork—Bases. Armstrong Cork Co., Lancaster, Pa.

Vibro-Bar—Bases and pads. Korfund Co., Long Island City, N. Y.

Vibro-Dampers — Bases. Korfund Co., Long Island City, N. Y.

Vibro Insulators—Bases. Goodrich Co., B. F., Akron, O.

Vibro-Isolator—Bases and pads. Korfund Co., Long Island City, N. Y.

Victor—Regulators. Atlas Valve Co., Inc., Newark, N. J.

Victor—Steam traps. Wright-Austin Co., Detroit, Mich.

Victoria—Venetian blinds. Bostwick-Goodell Co., Norwalk, O.

Victory—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Vim—Gaskets, leather packing. Houghten & Co., E. F., Philadelphia, Pa.

Vim Tred—Leather belting. Houghten & Co., E. F., Philadelphia, Pa.

Vistand—Vise stands. Armstrong Mfg. Co., Bridgeport, Conn.

Vitalaire—Air conditioning units. Ice Cooling Appliance Corp., Morrison, Ill.

Vitalloy—Wrenches. Billings & Spencer Co., Hartford, Conn.

Vitra-Carlite—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Vitriram—Furnace cement. U. S. Stoneware Co., New York, N. Y.

V-Meth-L — Refrigerant. Virginia Smelting Co., West Norfolk, Va.

Voladjuster—Dampers. Barber-Colman Co., Rockford, Ill.

Volcano—Ventilators. Iwan Brothers, South Bend, Ind.

Volocitrol—Louvers, regulators. Barber-Colman Co., Rockford, Ill.

Vol-U-Trol — Dampers. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Vortex—Pumps. Lawrence Pump & Engine Co., Lawrence, Mass.

Vortex—Nozzles. Phillips Cooling Tower Co., Inc., New York, N. Y.

V-tite—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

V-to-V—Pulleys and sheaves. Dayton Rubber Mfg. Co., Dayton, O.

Vulcalock—Fittings, pipe, tanks, valves. Goodrich Co., B. F., Akron, O.

Vulcan—Stands, tongs, vises. Williams & Co., J. H., Buffalo, N. Y.

Vulcan—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Vulco — Belts, drives. Gates Rubber Co., Denver, Col.

WHS—Couplings, pulleys and sheaves, reducers. Smith, Inc., Winfield H., Springville, N. Y.

WJ—Boiler cleaning compound. Radiator Specialty Co., Charlotte, N. C.

W. & McD.—Strainers, valves. Watson & McDaniel Co., Philadelphia, Pa.

W-S—Fittings. Watson Stillman Co., Roselle, N. J.

W & T—Feeders. Wallace & Tiernan Co., Inc., Belleville, N. J.

W-W—Pipe hangers. Western Wire Products Co., St. Louis, Mo.

Walco-Parmelee—Wrenches. Walworth Co., New York, N. Y.

Wallvane—Fans. Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Walseal Silbraz—Fittings, valves. Walworth Co., New York, N. Y.

Warco—Refractories. Walsh Refractories Corp., St. Louis, Mo.

Warco—Valves. Russell & Co., W. A., Bridgeport, Conn.

Wat-a-mat—Water meters. Pfening Co., Fred D., Columbus, O.

Watco—Cooling towers, spray nozzles, spraying systems. Water Cooling Corp., New York, N. Y.

Water-Boy—Feeders. Maid-O-Mist, Inc., Chicago, Ill.

Waterfilm—Heating boilers. Koven & Bro., Inc., L. O., Jersey City, N. J.

Water-Ray-Trola — Heaters. Ray Oil Burner Co., San Francisco, Cal.

Weaco—Preheaters, thermostats. Warren Electric Appliance Co., Warren, Pa.

Wear-Proof—Pumps. Schneible Co., Claude B., Chicago, Ill.

Wearweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Weathermaker—Unit air conditioners. Carrier Corp., Syracuse, N. Y.

Weathermaster—Unit air conditioners. Carrier Corp., Syracuse, N. Y.

Weatherstat—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Weatherwood—Insulation. United States Gypsum Co., Chicago, Ill.

Webster-Nesbitt—Unit heaters. Webster & Co., Camden, N. J.

Webster-Nesbitt—Unit heaters and air conditioners. Nesbitt, Inc., John J., Philadelphia, Pa.

Weco—Gas burners. Webster Engineering Co., Tulsa, Okla.

Wedgbelt—V belts and v-belt drives, pulleys. American Pulley Co., Philadephia, Pa.

Weir—Furnaces. Meyer Furnace Co., The, Peoria, Ill.

Weldells—Welding fittings. Taylor Forge & Pipe Works, Chicago, Ill.

Weldfast—Welding rod. Revere Copper and Brass, Incorporated, New York, N. Y.

Weldolets—Fittings. Bonney Forge & Tool Works, Allentown, Pa.

Weldomatic—Arc welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Weldotrol—Spot welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Weld-O-Tron—Arc welders. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Wesco—Fans, air conditioning units. Northwest Stove & Furnace Wks., Inc., Portland, Ore.

Westo—Water treatment. Western Chemical Co., Kansas City, Mo.

Whirlcone—Spray nozzles. Water Cooling Equipment Corp., St. Louis, Mo.

Whirljet—Spray nozzles. Spraying Systems Co., Chicago, Ill.

Whiz—Drills. Paramount Products Co., New York, N. Y.

Wilco—Bi-metals. Wilson Co., H. A., The, Newark, N. J.

Wilco—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Williams-Hager—Valves. Williams Gauge Co., Pittsburgh, Pa.

Wilson—Arc welders. Air Reduction Sales Co., New York, N. Y.

Windowstat—Condensation control. Friez & Sons, Julien P., Towson, Md.

Wind-O-Vane—Propeller fans. Sturtevant Co., B. F., Boston, Mass.

Wind-O-Vent—Window ventilator and filter units. Reed Unit-Fans, Inc., New Orleans, La.

Wing-Scruplex — Fans, ventilators. Wing Mfg. Co., L. J., New York, N. Y.

Winkler—Stokers. U. S. Machine Corp., Lebanon, Ind.

Wire-Kind—Air filters. Staynew Filter Corp., Rochester, N. Y.

Wissco—Grilles, welding rod. Wickwire Spencer Steel Co., New York, N. Y.

Witch—Hangers, protectors. Carpenter & Paterson, Inc., East Boston, Mass.

Witch-T. D.—Valves. Carpenter & Paterson, Inc., East Boston, Mass.

Wolverine—Fans, ventilators. Belanger Fan & Blower Co., Detroit, Mich.

Wrigley—Bolts. Chicago Expansion Bolt Co., Chicago, Ill.

X-L — Gaskets, packing. Excelsior Leather Washer Co., Rockford, Ill.

Xacto—Meters. Bowser & Co., Inc., S. F., Fort Wayne, Ind.

Xit—Ventilators. Iona Ventilator Co., Inc., Philadelphia, Pa.

Yager—Solder. Benson Co., Inc., Alex R., Hudson, N. Y.

Yarway — Alarms, clamps, expansion joints, nozzles, strainers, traps, valves. Yarnall-Waring Co., Philadelphia, Pa.

Yello-Jacket—Heating boilers. Burnham Boiler Corp., Irvington, N. Y.

Yorkaire—Unit air coolers. York Ice Machinery Corp., York, Pa.

Zephaire—Air conditioning units. American Metal Products Co., Fort Worth, Tex.

Zeph-O-Cone—Air diffusers. Waterloo Register Co., Waterloo, Ia.

Zim—Air filters. Chicago Filter Co., Joliet, Ill.

Zincgrip — Sheets. American Rolling Mill Co., Middletown, O.

Zonolite—Insulation. Robinson Insulation Co., Great Falls, Mont.

Zonolite—Insulation. Universal Zonolite Insulation Co., Chicago, Ill.

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS

PART 3—MANUFACTURERS' ADDRESSES

A

Acadia Synthetic Products Div., Western Felt Works, 4115 Ogden Ave., Chicago, Ill.
Accurate Mfg. Works, 2336-38 Milwaukee Ave., Chicago, Ill.
Accurate Metal Weather Strip Co., 216 E. 26th St., New York, N. Y.
Acer & Whedon, Inc., Medina, N. Y.
Acheson Mfg. Co., Braddock P. O., Rankin, Pa.
Acker Organization, Inc., W. M., 3167 Fulton Rd., Cleveland, O.
Ackermann Mfg. Co., Wheeling, W. Va.
Acme Asbestos Covering & Flooring Co., 236 N. Elizabeth St., Chicago, Ill.
Acme Electric Welder Co., 2618 Fruitland Rd., Los Angeles, Cal.
● Acme Industries, Inc., Cor. Mechanic and Ganson Sts., Jackson, Mich.
Acme Refining Co., The, W. 56th & W. & L. E. Ry., Cleveland, O.
Acme Tin Plate & Roofing Supply Co., 3rd and Westmoreland Sts., Philadelphia, Pa.
Acme White Lead & Color Works, 8250 St. Aubin Ave., Detroit, Mich.
Acorn Refining Co., 8001 Franklin Ave., Cleveland, O.
Activator Process Sales Co., 501 S. Marengo Ave., Alhambra, Cal.
Adam Electric Co., Frank, 3650 Windsor St., St. Louis, Mo.
Adams Co., The, E. 4th St., Dubuque, Ia.
Adams Co., Inc., R. P., 55 Chicago St., Buffalo, N. Y.
Advance Aluminum Castings Corp., 2742 W. 36th Pl., Chicago, Ill.
Advance Electric Co., 1260 W. Second St., Los Angeles, Cal.
Advance Fan & Blower Co., 3428 Bagley, Detroit, Mich.
Advance Insulating Co., Magee Bldg., Pittsburgh, Pa.
Advanced Refrigerating Systems Co., 33rd and Arch Sts., Philadelphia, Pa.
Aeco Packing Products Co., 215 W. Illinois St., Chicago, Ill.
Aeolus Dickinson, 3320 S. Artesian Ave., Chicago, Ill.
● Aerofin Corp., 410 S. Geddes St., Syracuse, N. Y.
Aeroil Burner Co., Inc., Park Ave. at 57th St., West New York, N. J.
Aerovent Fan Co., 710 E. Ash St., Piqua, O.
Aget-Detroit Mfg. Co., 2041 Book Bldg., Detroit, Mich.
Agnew Electric Co., Milford, Mich.
Ahlberg Bearing Co., 3081 W. 47th St., Chicago, Ill.
Air Conditioning Products Co., 1230-18th St., Detroit, Mich.
Air Control Products, Inc., Coopersville, Mich.
Air Controls, Inc., 1935 W. 114th St., Cleveland, O.
Air Devices, Inc., 17 E. 42nd St., New York, N. Y.
Air Filter Engineering Co., 2236 S. Wabash Ave., Chicago, Ill.
● Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.
● Air & Refrigeration Corp., 475 Fifth Ave., New York, N. Y.
Aire-Foile Fan & Blower Co., 4737 W. Vernor Highway, Detroit, Mich.
Airgard Mfg. Co., 609 N. La Salle St., Chicago, Ill.
Airmaster Corp., 4317 Ravenswood Ave., Chicago, Ill.
● Air-Maze Corp., 5200 Harvard Ave., Cleveland, O.
Airo Supply Co., 2726 N. Ashland Ave., Chicago, Ill.
AirO-Fin Register Co., 19159 John R St., Detroit, Mich.
Air-O-Cel Industries, Inc., 11616 Cloverdale Ave., Detroit, Mich.
Air-O-Line Co., The, 2118 Griffin St., Dallas, Tex.
Airox Co., 305 E. 46th St., New York, N. Y.
Air-Stream Filter Corp., 2100 Washington Ave., St. Louis, Mo.
Airtemp, Div. of Chrysler Corp., Leo St., Dayton, O.
● Airtherm Mfg. Co., 711 S. Spring Ave., St. Louis, Mo.
Airwasher Corp., 1122 N. Washington Ave., Lansing, Mich.
Ajax Flexible Coupling Co., Westfield, N. Y.
Akron Metallic Gasket Co., 155 N. Union, Akron, O.
Akwa Heaters, Inc., 1955 Park Ave., New York, N. Y.
Alabama Pipe Co., Anniston, Ala.
Albright Equipment Co., 100 Station St., Johnstown, Pa.
● Alco Valve Co., 2628 Big Bend Blvd., St. Louis, Mo.
Aldrich Pump Co., 4 Pine St., Allentown, Pa.
Alexander Bros., 406 N. 3rd, Philadelphia, Pa.
Alfol Insulation Co., Inc., 155 E. 44th St., New York, N. Y.
All Metal Weatherstrip Co., 229 W. Illinois St., Chicago, Ill.
Allegheny Ludlum Steel Corp., 2319 Oliver Bldg. (22), Pittsburgh, Pa.
Allen Billmyre Corp., 431 Fayette Ave., Mamaroneck, N. Y.
Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.
Allen Corp., 9767 Erwin Ave., Detroit, Mich.
Allied Weld-Craft, Inc., 401 W. South St., Indianapolis, Ind.
Allington & Curtis Mfg. Co., 1500 Holland Ave., Saginaw, Mich.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Allis Co., Louis, The, 427 E. Stewart St., Milwaukee, Wis.
Alloy Steel Products Co., 1000 W. Elizabeth Ave., Linden, N. J.
Allpax Co., Inc., Mamaroneck, N. Y.
All-Vac Steam Control System, 205 W. Wacker Dr., Chicago, Ill.
Alpha Metal & Rolling Mills, Inc., 363 Hudson Ave., Brooklyn, N. Y.
Alphil Spot Welding Co., 431 W. Broadway, New York, N. Y.
Alrose Chemical Co., Providence, R. I.
Alten's Foundry & Machine Works, 226 W. Wheeling St., Lancaster, O.
Alton Mineral Wool Insulation Co., P. O. Box 268, Alton, Ill.
Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh, Pa.
American Agile Corp., 5806 Hough Ave., Cleveland, O.
American Air Conditioning Co., Boulevard Bldg., Detroit, Mich.
● American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky.
American Blower Corp., Box 58, Roosevelt Park Annex, Detroit, Mich.
● American Brass Co., 414 Meadow St., Waterbury, Conn.
American Car & Foundry Co., 36 Church St., New York, N. Y.
American Cast Iron Pipe Co., 2930 N. 16th St., Birmingham, Ala.
American Coal Burner Co., 18 E. Erie St., Chicago, Ill.
American Coils, Inc., 25-27 Lexington St., Newark, N. J.
American Coolair Corp., 3604 Mayflower St., Jacksonville, Fla.
American Cooling Tower Co., 2710 McGee St., Kansas City, Mo.
● American District Steam Co., 25 Bryant St., North Tonawanda, N. Y.
American Engineering Co., Aramingo Ave. and Cumberland St., Philadelphia, Pa.
American Flange & Mfg. Co., Inc., 1901 R. C. A. Bldg., New York, N. Y.
American Flexible Coupling Co., 1801 Pittsburgh Ave., Erie, Pa.
American Foundry Equipment Co., 619 S. Byrkit St., Mishawaka, Ind.
American Foundry & Furnace Co., Washington St. at McClun, Bloomington, Ill.
American Furnace Co., 2719-31 Delmar Blvd., St. Louis, Mo.
American Hair & Felt Co., 1828 Merchandise Mart, Chicago, Ill.
American Hammered Piston Ring Div., Koppers Co., Bush and Hamburg Sts., Baltimore, Md.
American Hard Rubber Co., 11 Mercer St., New York, N. Y.
American Injector Co., 1481-14th St., Detroit, Mich.
American Instrument Co., Silver Spring, Md.
American K. A. T. Corp., 331 Madison Ave., New York, N. Y.
American-LaFrance-Foamite Corp., 100 E. LaFrance St., Elmira, N. Y.
American-Larson Ventilating Co., 1004 Keystone Bank Bldg., Pittsburgh, Pa.
American Locomotive Co., Alco Products Div., 30 Church St., New York, N. Y.
American Locomotive Co., Diesel Engine Div., Auburn, N. Y.
American Manganese Bronze Co., Rhawn & Hegerman Sts., Philadelphia, Pa.
American-Marsh Pumps, Inc., 60 Capital Ave., N. E., Battle Creek, Mich.
American Metal Hose Branch, American Brass Co., 67 Jewelry St., Waterbury, Conn.
American Metal Products Co., 730 Hudgins St., Forth Worth, Tex.
American Metal Weather Strip Co., 144 N. Division Ave., Grand Rapids, Mich.
American Meter Co., Inc., 60 E. 42nd St., New York, N. Y.
American Moistening Co., 260 W. Exchange St., Providence, R. I.
American Nickeloid Co., 113 Second St., Peru, Ill.
American Pipe Bending Machine Co., Inc., 37 Pearl St., Boston, Mass.
American Pipe Tool Co., 4856 W. Kinzie St., Chicago, Ill.
American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa.
American Radiator & Standard Sanitary Corp., Bessemer Bldg., Pittsburgh, Pa.
● American Rolling Mill Co., The, 703 Curtis St., Middletown, O.
American Schaefer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., 11 Elias St., Bridgeport, Conn.

● Advertisement in this issue. See Index to Advertisers, page 306.

American Sheet Metal Works, 331 N. Alexander, New Orleans, La.
●American Smelting & Refining Co., 120 Broadway, New York, N. Y.
American Solder & Flux Co., 2152 E. Norris St., Philadelphia, Pa.
American Steel Band Co., Bowman Bldg., Pittsburgh, Pa.
American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
American Sterilizer Co., Erie, Pa.
American Teksag Products Co., Inc., 395 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
American Thermometer Co., 2907 Clark Ave., St. Louis, Mo.
American Warming & Ventilating Co., 1017-1021 Summit St., Toledo, O.
American Water Softener Co., Lehigh Ave. and 4th St., Philadelphia, Pa.
American Well Wks., 100 N. Broadway, Aurora, Ill.
American Zinc Products Co., Greencastle, Ind.
Ames Co., W. R., 150 Hooper St., San Francisco, Cal.
Ames Hydrovac Corp., 290 Scholes St., Brooklyn, N. Y.
Ames Iron Works, Division of Pierce Butler Radiator Corp., Oswego, N. Y.
Amirton Co., Inc., 27 Pearl St., New York, N. Y.
Anchor Packing Co., 401 N. Broad St., Philadelphia, Pa.
Anchor Stove & Range Co., Third & Culbertson Sts., New Albany, Ind.
Andale Co., 1604 Arch, Philadelphia, Pa.
Andersen Corp., Bayport, Minn.
●Anderson Co., V. D., The, 1949 W. 96th St., Cleveland, O.
Anderson Engine & Foundry Co., Anderson, Ind.
Andersen Products, Inc., 17 Tudor St., Cambridge, Mass.
Anderson-Stolz Corp., 1731 Walnut St., Kansas City, Mo.
●Anemostat Corp. of America, 10 E. 39th St., New York, N. Y.
Anetsberger Bros., 3505 Elston Ave., Chicago, Ill.
Annis Air Filters, 1515 Gardena St., Glendale, Cal.
Ansul Chemical Co., Marinette, Wis.
Apollo Steel Co., 609 Warren Ave., Apollo, Pa.
April Showers Co., 4126 Eighth St., N.W., Washington, D. C.
Aqua-Mist Co., 426 Jefferson St., Topeka, Kans.
Aqua-Restor Div., Mayer Mfg. Corp., 50 Division Pl., Brooklyn, N. Y.
Aqua-Sorb Co., 21 S. 16th St., East Orange, N. J.
Aquatic Chemical Laboratories, Inc., 95 Liberty St., New York, N. Y.
Arcos Corp., 401 N. Broad St., Philadelphia, Pa.
Arcweld Mfg. Co., Inc., 3469 Third Ave., W., Seattle, Wash.
Arex Co., 333 N. Michigan Ave., Chicago, Ill.
Armour Ammonia Works, 1355 W. 31st St., Chicago, Ill.
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Rd., Chicago, Ill.
Armstrong Bros. Tool Co., 317-357 N. Francisco Ave., Chicago, Ill.
Armstrong Co., The, Post Ave. and South St., Detroit, Mich.
●Armstrong Cork Co., 994 Concord St., Lancaster, Pa.
Armstrong Heat Control Co., 1626 N.E. Union Ave., Portland, Ore.
●Armstrong Machine Wks., 874 Maple St., Three Rivers, Mich.
Armstrong Mfg. Co., 303 Knowlton St., Bridgeport, Conn.
●Arrow-Hart & Hegeman Elect. Co., 103 Hawthorn St., Hartford, Conn.
Art Valve Co., 4237 N. Lincoln, Chicago, Ill.
Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Ashton Valve Co., 161-1st St., Cambridge, Mass.
Askania Regulator Co., 1605 S. Michigan Ave., Chicago, Ill.
Asphalt Products Co., Eastwood Sta., Syracuse, N. Y.
Athey Co., 6035-43 W. 65th St., Chicago, Ill.
Atkins & Co., E. C., 402 S. Illinois St., Indianapolis, Ind.
Atlantic Metal Hose Co., Inc., 123 W. 64th St., New York, N. Y.
Atlantic Steel Boiler Co., 21st St. and Washington Ave., Philadelphia, Pa.
Atlas Chemical Co., Marietta, O.
Atlas Heating & Ventilating Co., Ltd., 557 Fourth St., San Francisco, Cal.
Atlas Valve Co., Inc., 282 South St., Newark, N. J.
Auburn Foundry Inc., Stoker Div., Auburn, Ind.
Auditorium Conditioning Corp., 17 E. 42nd St., New York, N. Y.
●Auer Register Co., 3608 Payne Ave., Cleveland, O.
Aurora Pump Co., 619 Loucks St., Aurora, Ill.
Austin-Mason Co., 15 Park Row, New York, N. Y.
Au-Temp-Co Corp., 33 W. 60th St., New York, N. Y.
Autoforce Ventilating System, 244 Washington St., Boston, Mass.
Automatic Control Co., 1005 University Ave., St. Paul, Minn.
Automatic Gas Equipment Co., 301 Brushton Ave., Pittsburgh, Pa.
●Automatic Products Co., 2450 N. 32nd St., Milwaukee, Wis.
Automatic Pump & Softener Corp., 1907 Kishwaukee St., Rockford, Ill.
Automatic Switch Co., 41 E. 11th St., New York, N. Y.
Automatic Temperature Control Co., Inc., 44 E. Logan St., Philadelphia, Pa.
Automatic Ventilator Co., 503 S. Shiawasse, Corunna, Mich.
Automotive Maintenance Machinery Co., North Chicago, Ill.
Autovent Fan & Blower Div., The Herman Nelson Corp., 1805-1827 N. Kostner Ave., Chicago, Ill.
Azor Corp., 107 Montgomery Ave., Irvington, N. J.

B

Babcock & Wilcox Co., 85 Liberty St., New York, N. Y.
Babcock & Wilcox Tube Co., The, Beaver Falls, Pa.
Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh, Pa.
Bache & Co., Semon, Greenwich & Morton Sts., New York, N. Y.
●Badger & Sons Co., E. B., 75 Pitts St., Boston, Mass.
Badger Fire Extinguisher Co., 624 Somerville Ave., Somerville, Mass.
Baer Bros., 438 W. 37th St., New York, N. Y.
Bahnson Co., 1001 S. Marshall St., Winston-Salem, N. C.
Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, O.
●Baker Ice Machine Co., Inc., 1509 Evans St., Omaha, Nebr.
Baldor Electric Co., 4353 Duncan Ave., St. Louis, Mo.
Baldwin De La Vergne Sales Corp., Paschall P. O., Philadelphia, Pa.
Baldwin-Hill Co., 531 Klagg Ave., Trenton, N. J.
Ballantyne Co., 222 N. 16th St., Omaha, Nebr.
Balloffet Dies and Nozzle Co., Inc., 6825 Adams St., Guttenberg, N. J.
Baltimore Air Coil Co., 410 W. Redwood St., Baltimore, Md.
Bantam Bearings Corp., South Bend, Ind.
Barber Asphalt Corp., Barber, N. J.
Barber Gas Burner Co., 3704 Superior Ave., Cleveland, O.
●Barber-Colman Co., 225 Loomis St., Rockford, Ill.
Barclay, Inc., Robert, 128 N. Peoria St., Chicago, Ill.
Barco Mfg. Co., 1801 Winnemac Ave., Chicago, Ill.
Bardco Mfg. & Sales Co., 2450 E. 23rd St., Los Angeles, Cal.
Barium Stainless Steel Corp., 1502 Allen Ave., S. E., Canton, O.
Barland Weatherstrip Material Co., 1960 E. 59th St., Cleveland, O.
Barnes & Jones, Inc., 128 Brookside Ave., Jamaica Plain, Boston, Mass.
Barnes Tool Co., The, 152 Brewery St., New Haven, Conn.
Barrett Div., The, Allied Chemical & Dye Corp., 40 Rector St., New York, N. Y.
Barrett, Haentjens & Co., Hazleton, Pa.
Barrett Machine Co., 912-916 Behan St., N. S., Pittsburgh, Pa.
Bartlett Mfg. Co., 3003 E. Grand Blvd., Detroit, Mich.
Bass Foundry & Machine Co., 1602-1734 Hanna St., Ft. Wayne, Ind.
Bausch & Lomb Optical Co., 635 St. Paul St., Rochester, N. Y.
Bayer Co., 4030 Chouteau Ave., St. Louis, Mo.
Bayley Blower Co., 1817 S. 66th St., Milwaukee, Wis.
Beach-Russ Co., 64A Church St., New York, N. Y.
Beacon-Morris Corp., 702 Beacon St., Boston, Mass.
Bear Mfg. Co., Rock Island, Ill.
Bearings Co. of America, 501 Harrisburg Ave., Lancaster, Pa.
Beaton & Cadwell Mfg. Co., 185 Main St., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
Beatty Machine & Mfg. Co., 934 150th St., Hammond, Ind.
Beaver Pipe Tools, Inc., 310 Dana Ave., Warren, O.
Beck Engineering Combustion Kompany, 3033 Spruce St., St. Louis, Mo.
Beckley Perforating Co., 315 North Ave., Garwood, N. J.
Belanger Fan & Blower Co., 1230 18th St., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., 3830-32 Olive St., St. Louis, Mo.
Belfield Co., H., 435 N. Broad St., Philadelphia, Pa.
Belknap Mfg. Co., 800 Union Ave., Bridgeport, Conn.
●Bell & Gossett Co., Morton Grove, Ill.
Belmont Packing & Rubber Co., The, Butler & Sepviva Sts., Philadelphia, Pa.
Belmont Smelting & Refining Wks., Inc., 349 Belmont Ave., Brooklyn, N. Y.
Bender Warrick Corp., 131 Pierce, Birmingham, Mich.
●Bendix Aviation Corp., Philadelphia Div., Philadelphia, Pa.
Benjamin Air Rifle Co., 1527 S. 8th St., St. Louis, Mo.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Bennett Oil Co., 964 S. Saddle Creek Rd., Omaha, Nebr.
Benson Co., Inc., Alex R., 1040 Bay Rd., So. Hudson, N. Y.
Berger Bros. Co., 229-237 Arch St., Philadelphia, Pa.
Berger Mfg. Div., Republic Steel Corp., 1038 Belden Ave., Canton, O.
Berns Specialty Mfg. Co., 1015 W. Lake St., Chicago, Ill.
Bernz Co., Inc., Otto, 280 Lyell Ave., Rochester, N. Y.
Berry, Jr., & Co., Inc., F. E., Everett, Mass.
Bertsch & Co., Inc., Church St., Cambridge City, Ind.
Best Register Co., 2005 W. Oklahoma Ave., Milwaukee, Wis.
Bethlehem Foundry & Machine Co., W. Second St., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Betz Air Conditioning Corp., 1820 Wyandotte St., Kansas City, Mo.
Betz Corp., 460 State St., Hammond, Ind.
Beverly Throatless Shear Co., 3009 W. 110th Pl., Chicago, Ill.
Bien Air Conditioning Co., Bell, Calif.
Bigelow Co., 92 River St., New Haven, Conn.
Biggs Boiler Wks. Co., Case Ave. & B. & O. R. R., E. Akron, O.
Bignall & Keeler Machine Wks., Edwardsville, Ill.
Billings & Spencer Co., 1 Laurel St., Hartford, Conn.
Binkley Mfg. Co., Warrenton, Mo.
Binks Mfg. Co., 3114-40 Carroll Ave., Chicago, Ill.
Bird-Archer Co., 4337 North America St., Philadelphia, Pa.
Bishop & Babcock Mfg. Co., 4901 Hamilton Ave., Cleveland, O.
Black & Decker Mfg. Co., Pennsylvania Ave., Towson, Md.
Black Magic Products Co., P. O. Box 1703, Tulsa, Okla.
Black-Sivalls & Bryson, Inc., 7501 E. 10th St., Kansas City, Mo.
Blackhawk Mfg. Co., 5325 W. Rogers St., Milwaukee, Wis.

● Advertisement in this issue. See Index to Advertisers, page 306.

Blackmer Pump Co., 1920A Century Ave., S. W., Grand Rapids, Mich.
Blaisdell Compressor Co., 227 Fulton St., New York, N. Y.
Bliss Co., E. W., 1420 Hastings St., Toledo, O.
Blocksom & Co., E. 5th St., Michigan City, Ind.
Blood Brothers Machine Co., Allegan, Mich.
Blower Application Co., 918 N. Fourth St., Milwaukee, Wis.
Blue Seal Chemical Co., 177 Westfield Ave., W., Roselle Park, N. J.
Bluffton Mfg. Co., The, 433 W. Main Cross St., Findlay, O.
Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill.
Boester, Carl F., 101 E. Essex—Kirkwood, St. Louis, Mo.
Bogue Electric Co., 80 Glover Ave., Paterson, N. J.
Bohn Aluminum & Brass Corp., 2306 Franklin St., Detroit, Mich.
Boiler Room Equipment, Inc., 468 Fourth Ave., New York, N. Y.
●Bonney Forge & Tool Wks., Tilghman St. & Meadow St., Allentown, Pa.
Bordo Co., Inc., L. J., 115 New St., Glenside, Pa.
Borm Mfg. Co., Elgin, Ill.
Boston Auto Gage Co., 70 West St., Pittsfield, Mass.
Boston Gear Works, Inc., North Quincy, Mass.
Boston Woven Hose & Rubber Co., 29 Hampshire St., Cambridge, Mass.
Bostwick-Goodell Co., Norwalk, O.
Botfield Refractories Co., Swanson & Clymer Sts., Philadelphia, Pa.
Bowser & Co., Inc., S. F., 1302 E. Creighton Ave., Fort Wayne, Ind.
Boylston Steam Specialty Co., 116-122 W. Illinois St., Chicago, Ill.
Brasco Mfg. Co., Harvey, Ill.
Brauer Supply Co., A. G., 2100 Washington Ave., St. Louis, Mo.
Breidert Co., G. C., 3328 S. Central Ave., Los Angeles, Cal.
Bremil Mfg. Co., Box 1030, Erie, Pa.
Bridgeport Brass Co., 30 Grand St., Bridgeport, Conn.
Bridgeport Thermostat Co., Inc., Connecticut Ave., Bridgeport, Conn.
Bristol Co., The, P.O. Box 1790, Waterbury, Conn.
Brooke Engineering Co., Inc., 4517 Wayne Ave., Philadelphia, Pa.
●Brooks Equipment Corp., 90 West Ave., New York, N. Y.
Bros Boiler & Mfg. Co., Wm., Nicollet Island, Minneapolis, Minn.
Brown-Brockmeyer Co., Inc., 1098 Smithville Rd., Dayton, O.
Brown Fintube Co., The, Elyria, O.
Brown-Ford Corp., Newton, Mass.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulater Co., 4534 Wayne Ave., Philadelphia, Pa.
Brownell Co., 800 N. Findlay St., Dayton, O.
Browning Mfg. Co., Inc., 1940 Browning Blvd., Maysville, Ky.
Brundage Co., The, 500-514 N. Park St., Kalamazoo, Mich.
Bruning Co., Inc., Charles, 42-33 Ninth St., Long Island City, N. Y.
Brunner Mfg. Co., 1821 E. Broad St., Utica, N. Y.
Bryan Steam Corp., P. O. Box 337, Peru, Ind.
Bryant Heater Co., The, 17825 St. Clair Ave., Cleveland, O.
Bubar, Hudson H., 15 Park Row, New York, N. Y.
Buckeye Products Co., 7024 Vine St., Cincinnati, O.
Buda Co., Harvey, Ill.
●Buffalo Forge Co., 171 Mortimer St., Buffalo, N. Y.
Buffalo Meter Co., 2917 Main St., Buffalo, N. Y.
●Buffalo Pumps, Inc., 171 Mortimer St., Buffalo, N. Y.
Buffalo Tank Co., Dunellen, N. J.
Builders-Providence, Inc., Div. of Builders Iron Foundry, 9 Codding St., Providence, R. I.
●Bullard Co., The, 286 Canfield Ave., Bridgeport, Conn.
Bundy Steam Trap Co., Nashua, N. H.
Bundy Tubing Co., 10951 Hern, Detroit, Mich.
Burhorn Co., Edwin, 554 W. 48th St., New York, N. Y.
Burke Electric Co., 1201 W. 12th St., Erie, Pa.
Burke Stoker & Mfg. Co., 921 W. 19th St., Chicago, Ill.
Burling Instrument Co., Air Conditioning Div., 253 Springfield Ave., Newark, N. J.
●Burnham Boiler Corp., Main St., Irvington, N. Y.
Burnham Stoker Co., 505 Columbia St., Vancouver, Wash.
Burnley Battery & Mfg. Co., Clay St., North East, Pa.
Burrows Mfg. Co., F. A., 318 E. Poplar St., York, Pa.
Burt Mfg. Co., 635 Main St., Akron, O.
Bury Compressor Co., 18th & Cascade Sts., Erie, Pa.
●Bush Mfg. Co., 100 Wellington St., Hartford, Conn.
Butterworth, B. T., Jr., New Canaan, Conn.
●Byers Co., A. M., Clark Bldg., Pittsburgh, Pa.
Byron Jackson Co., P. O. Box 2017, Terminal Annex, Los Angeles, Cal.

C

Cabot, Inc., Samuel, 141 Milk St., Boston, Mass.
Calbar Paint & Varnish Co., 2612-26 N. Martha St., Philadelphia, Pa.
Caldwell Co., W. E., 2120 Brook St., Louisville, Ky.
Calgon, Inc., 323 Fourth Ave., Pittsburgh, Pa.
Callahan Can Machine Co., Inc., 80 Richard St., Brooklyn, N. Y.
Calorider Corp., 1 Atlantic St., Stamford, Conn.
Caloroil Burner Corp., 1477 Park St., Hartford, Conn.
Campbell Heating Co., E. K., 2445 Charlotte St., Kansas City, Mo.
Campbell Heating Co., 31st & Dean, Des Moines, Ia.
Canatsey Electric Mfg. Co., 620 Wyandotte St., Kansas City, Mo.
●Cannon Chemical Co., 210 Broadway, Everett, Mass.
Canton Stoker Corp., 407 Andrew Place, S. W., Canton, O.
Canvas Products Co., 1236 S. 7th St., St. Louis, Mo.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., 2306 Franklin St., Detroit, Mich.
Carbide and Carbon Chemicals Corp., 30 E. 42nd St., New York, N. Y.
●Carey Mfg. Co., Philip, Wayne Ave., Lockland, Cincinnati, O.
Carling Turbine Blower Co., 25 St. John's Rd., Worcester, Mass.
Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh, Pa.
Carnes, Inc., John R., Greenlawn Ave. & Erie R. R., Lima, O.
Carney Rockwool Co., Mankato, Minn.
Carpenter & Paterson, Inc., 1190 Bennington St., East Boston, Mass.
Carpenter Steel Co., The, Welded Alloy Tube Div., Kenilworth, N. J.
Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.
Carty & Moore Engineering Co., 511 W. Larned St., Detroit, Mich.
Case & Son Mfg. Co., W. A., 33 Main St., Buffalo, N. Y.
●Cash Co., A. W., P. O. Box 135, Decatur, Ill.
Cashin Co., W. D., 69 A St., Boston, Mass.
Catawissa Valve & Fittings Co., Catawissa, Pa.
Caterpillar Tractor Co., 600 W. Washington St., Peoria, Ill.
Celanese Celluloid Corp., 180 Madison Ave., New York, N. Y.
Celotex Corp., The, 120 S. LaSalle Bldg., Chicago, Ill.
Central Brass Mfg. Co., 2950 E. 55th St., Cleveland, O.
Central Die Casting & Mfg. Co., Inc., 2935 W. 47th St., Chicago, Ill.
Central Foundry Co., 386 Fourth Ave., New York, N. Y.
Central Station Steam Co., 2920 E. Woodbridge St., Detroit, Mich.
Central Valve Mfg. Co., 255 E. 95th St., Chicago, Ill.
Central Wire & Iron Works, 621 E. Locust St., Des Moines, Ia.
Centrifix Corp., 3029 Prospect Ave., Cleveland, O.
●Century Electric Co., 1806 Pine St., St. Louis, Mo.
Century Engineering Corp., 401-431 3rd St., S. E., Cedar Rapids, Ia.
Century Fan & Ventilator Co., 103 E. 125th St., New York, N. Y.
Certain-teed Products Corp., 100 E. 42nd St., New York, N. Y.
Certified Flexible Couplings, 369 Lexington Ave., New York, N. Y.
Certified Gauge & Instrument Corp., Maytag Bldg. at 34th St., Long Island City, N. Y.
Chace Co., W. M., 1606 Beard Ave., Detroit, Mich.
Chain Belt Co., 1617 W. Bruce, Milwaukee, Wis.
Chamberlin Metal Weather Strip Co., 1254 La Brosse St., Detroit, Mich.
Champion Blower & Forge Co., Harrisburg Ave. and Charlotte St., Lancaster, Pa.
Champion Furnace Pipe Co., 918 S. Adams St., Peoria, Ill.
Champion Machine & Forging Co., 3678 E. 78th St., Cleveland, O.
Champion Unit Heater Co., 4639-41 Washington Blvd., Chicago, Ill.
Chandler Co., 804 First Ave., N. W., Cedar Rapids, Ia.
Chaplin-Fulton Mfg. Co., 28-40 Penn Ave., Pittsburgh, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Char-Gale Mfg. Co., 3127 Hiawatha Ave., Minneapolis, Minn.
Chase Brass & Copper Co., 236 Grand St., Waterbury, Conn.
Chelsea Fan & Blower Co., 1206 S. Grove St., Irvington, N. J.
Chelsea Metal Stamping Co., 95 8th Ave., New York, N. Y.
Cheney Metal Products Co., 33 Oxford St., Trenton, N. J.
Chesapeake & Ohio R.R. Co., Terminal Tower, Cleveland, O.
Chicago Belting Co., 113-125 N. Green St., Chicago, Ill.
Chicago Bridge & Iron Co., 332 S. Michigan Ave., Chicago, Ill.
Chicago Die Casting Mfg. Co., 2515 W. Monroe St., Chicago, Ill.
Chicago Expansion Bolt Co., 2240 W. Ogden Ave., Chicago, Ill.
Chicago Filter Co., Joliet, Ill.
Chicago Fire Brick Co., 1467 N. Elston Ave., Chicago, Ill.
Chicago Furnace Supply Co. 1278 Clybourn Ave., Chicago, Ill.
Chicago Metal Hose Corp., Maywood, Ill.
Chicago Metal Mfg. Co., 3724 S. Rockwell St., Chicago, Ill.
Chicago Nipple Mfg. Co., 1966 Southport Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Chicago Pump Co., 2323 Wolfram St., Chicago, Ill.
Chicago Specialty Mfg. Co., 332 N. Western Ave., Chicago, Ill.
Chicago Steel & Wire Co., 103rd St. and Torrence Ave., Chicago, Ill.
Chicago Venetian Blind Co., 2427 W. 14th St., Chicago, Ill.
Chicago-Wilcox Mfg. Co., E. 77th St. and Anthony Ave., Chicago, Ill.
Chisholm Co., Allen E., 2640 E. Burnside St., Portland, Ore.
Cincinnati Electrical Tool Co., The, 2684 Madison Rd., Cincinnati, O.
Cincinnati Shaper Co., Hopple, Garrard & Elam, Cincinnati, O.
Cincinnati Sheet Metal & Roofing Co., 230 E. Front St., Cincinnati, O.
Circulators & Devices Mfg. Corp., 100 Prince St., New York, N. Y.
Cissell Mfg. Co., W. M., 831 S. First St., Louisville, Ky.
●Clarage Fan Co., Porter St., Kalamazoo, Mich.

● Advertisement in this issue. See Index to Advertisers, page 306.

Clark Bros. Bolt Co., Milldale, Conn.
Clark Controller Co., 1146 E. 152nd St., Cleveland, O.
Clark Cooper Co., Palmyra, N. J.
Clark Dust Control Co., 210 N. Mozart St., Chicago, Ill.
Clark Jr., Electric Co., Jas., 600 Bergman St., Louisville, Ky.
Clauss Shear Co., Fremont, O.
Clay Equipment Corp., Cedar Falls, Ia.
Clayton & Lambert Mfg. Co., 11111 French Rd., Detroit, Mich.
Cleaver-Brooks Co., 5100 N. 33rd St., Milwaukee, Wis.
Clees Valve & Engineering Co., 140 Cedar St., New York, N. Y.
Cleghorn Co., 86 Broad St., Boston, Mass.
Cleveland Punch & Shear Works Co., E. 40th and St. Clair Ave., Cleveland, O.
●Clifford Mfg. Co., 564 E. First St., Boston, Mass.
Clinton Metallic Paint Co., P. O. Box 278, Clinton, N. Y.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Clow & Sons, James B., 201-299 N. Talman Ave., Chicago, Ill.
Cochrane Corp., 3131 N. 17th St., Philadelphia, Pa.
Coe Mfg. Co., Bank St., Painesville, O.
Cohoes Rolling Mill Co., Canvass and Cortland Sts., Cohoes, N. Y.
Cole-Sullivan Engineering Co., 1316 Third St., N. Minneapolis, Minn.
Colebrook & Sons, Inc., W. H., 246 Walton St., Syracuse, N. Y.
Colonial Alloys Co., Metals Div., E. Somerset, Trenton Ave. and Reading R. R., Philadelphia, Pa.
Columbia Mills, Inc., Saginaw, Mich.
Columbia Radiator Co., 3400 Walnut St., McKeesport, Pa.
Columbia Steel Co. (Sub. United States Steel Corp.), Russ Bldg., 235 Montgomery St., San Francisco, Cal.
Columbian Steel Tank Co., 1509 W. 12th St., Kansas City, Mo.
Columbus Heating & Ventilating Co., 182 N. Yale Ave., Columbus, O.
Columbus Metal Products, Inc., 767 N. 4th St., Columbus, O.
Columbus Steam Pump Wks. Co., 724 W. Gay St., Columbus, O.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., 200 Madison Ave., New York, N. Y.
Comfort Products Corp., 7 W. 147th St., Harvey, Ill.
Commercial Shearing & Stamping Co., 1775 Logan, Youngtown, O.
Commonwealth Brass Corp., 5781-5835 Commonwealth Ave., Detroit, Mich.
Commonwealth Electric Welder Mfg. Co., 3200-F W. Oxford St., Philadelphia, Pa.
Conco Corp., Div. of H. D. Conkey & Co., Mendota, Ill.
Conditionaire Unit Co., 2821 Montrose Ave., Chicago, Ill.
Congress Die Casting Div., Congress Tool & Die Co., 3750 E. Outer Drive, Detroit, Mich.
Conklin Brass & Copper Co., Inc., T. E., 54-60 Laayette St., New York, N. Y.
Conneaut Packing Co., Conneaut, O.
Connery Construction Co., 2nd and Luzerne Sts., Philadelphia, Pa.
●Connor Engineering Corp., W. B., Dorex Div., 114 E. 32nd St., New York, N. Y.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Consolidated Safety Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Continental Diamond Fibre Co., Newark, Del.
Continental Electric Co., Inc., 323 Ferry St., Newark, N. J.
Continental Motors Corp., Muskegon, Mich.
Continental Products Co., 1150 E. 222nd St., Euclid, O.
Continental Rubber Wks., 1902 Liberty Blvd., Erie, Pa.
Continental Steel Corp., 1108 S. Main St., Kokomo, Ind.
Continental Stove Corp., Front and Walnut Sts., Ironton, O.
Cook, Inc., A. D., Lawrenceburg, Ind.
Cook Electric Co., 2700 Southport Ave., Chicago, Ill.
Cooper-Bessemer Corp., The, 200 Thomas Ave., Mt. Vernon, O.
Cooper Co., Clark, Palmyra, N. J.
Cooper Sanitary Co., 3601 Ludlow St., Philadelphia, Pa.
Copeland Refrigeration Corp., Sidney, O.
Coppus Engineering Corp., 374 Park Ave., Worcester, Mass.
Corbman Bros., Inc., 1205 N. Fourth St., Philadelphia, Pa.
Cork Import Corp., 330 W. 42nd St., New York, N. Y.
Cork Insulation Co., Inc., 155 E. 44th St., New York, N. Y.
Corley Co., 629 Grove St., Jersey City, N. J.
Corning Glass Works, Corning, N. Y.
Coroaire Heater Corp., The, 1124 Hanna Bldg., Cleveland, O.
Cramer Co., Inc., R. W., The, Centerbrook, Conn.
●Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Crane Packing Co., 1801 Belle Plaine Ave., Chicago, Ill.
Crawford Co., 3220 W. 31st St., Chicago, Ill.
Crescent Tool Co., 230 Harrison St., Jamestown, N. Y.
Crise Elec. Mfg. Co., 2040 E. Main, Columbus, O.
Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.
Croll-Reynolds Engineering Co., Inc., 17 Johns St., New York, N. Y.
Croll & Son, Jesse G., 2326-2606 Germantown Ave., Philadelphia, Pa.
Cross Engineering Co., 160-178 Dundaff St., Carbondale, Pa.
Crown Die & Tool Co., 108 N. Jefferson St., Chicago, Ill.
Crown Iron Works, 1229 N. E. Tyler, Minneapolis, Minn.
Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y.
Cryer Trap & Valve Co., Inc., 366 Madison Ave., New York, N. Y.
Cugley Incubator Co., Elkhart, Ind.
Cuno Engineering Corp., 80 S. Vine St., Meriden, Conn.
Curtis & Curtis Co., The, 450 Garden St., Bridgeport, Conn.
●Curtis Refrigerating Machine Co., 1950 Kienlen Ave., St. Louis, Mo.
Cutler-Hammer, Inc., 315 N. 12th St. Milwaukee, Wis.
Cyrus Shank Co., 625 W. Jackson Blvd., Chicago, Ill.

D

Dallas Engineering Co., Inc., 2000 S. Akard, Dallas, Tex.
Dampney Co. of America, 1243 River St., Hyde Park, Boston, Mass.
Darcoid Co., Inc., 145 Sixth Ave., New York, N. Y.
Darling Valve & Mfg. Co., 701 First St., Williamsport, Pa.
Dart Mfg. Co., E. M., 134 Thurbers Ave., Providence, R. I.
Davey Compressor Co., Kent, O.
Davidson Co., M. T., 154 Nassau St., New York, N. Y.
Davidson Hy Duty Roof Fan Co., 213 California St., Newton, Mass.
Davies Air Filter Corp., 118-120 E. 25th St., New York, N. Y.
Davis & Co., Inc., Dean W., 549 W. Fulton St., Chicago, Ill.
Davis Engineering Corp., 1064 E. Grand St., Elizabeth, N. J.
Davis Regulator Co., 2546 S. Washtenaw Ave., Chicago, Ill.
Davison Chemical Corp., The, 20 Hopkins Place, Baltimore, Md.
Day Co., The, 2938 Pillsbury Ave., Minneapolis, Minn.
Dayton Air Compressor Co., Dayton, O.
Dayton-Dowd Co., 115-17 York St., Quincy, Ill.
Dayton Rubber Mfg. Co., 2345 W. Riverview Ave., Dayton, O.
●Dean Brothers Pumps, Inc., 323 W. 10th St., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Dearborn Chemical Co., 310 S. Michigan Ave., Chicago, Ill.
Debevoise Co., The, 968 Grand St., Brooklyn, N. Y.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., East Moline, Ill.
Decatur Iron & Steel Co., Decatur, Ala.
Decatur Pump Co., 2750 Nelson Park Rd., Decatur, Ill.
Defender Automatic Regulator Co., 308 S. 8th St., St. Louis, Mo.
De Laval Steam Turbine Co., 300 Nottingham Way, Trenton, N. J.
Delco Appliance Div., General Motors Corp., Rochester, N. Y.
Delco Products Div., General Motors Corp., 329 E. First St., Dayton, O.
Delta-Star Electric Co., 2400 Block, W. Fulton St., Chicago, Ill.
Deming Co., 14 Aetna St., Salem, O.
Demuth & Sons, Charles, P. O. Box 74, New Hyde Park, Garden City Park, L. I.
Desmond-Stephan Mfg. Co., Urbana, O.
Desolvo Co., Tne, 31 Terminal Way, Pittsburgh, Pa.
Despatch Oven Co., 600 Ninth St., S. E., Minneapolis, Minn.
Detroit Air Meter Co., Box 1473, Detroit, Mich.
Detroit Brass & Malleable Works, 100 S. Campbell, Detroit, Mich.
Detroit Graphite Co., 550 12th St., Detroit, Mich.
Detroit Lubricator Co., 5900 Trumbull Ave., Detroit, Mich.
Detroit Seamless Steel Tubes Co., c/o Grand River Station, Detroit, Mich.
●Detroit Stamping Co., 350 Midland Ave., Detroit, Mich.
Detroit Steel Products Co., 2250 E. Grand Blvd., Detroit, Mich.
Detroit Stoker Co., Sales and Engineering Offices, General Motors Bldg., Detroit, Mich.; Works at Monroe, Mich.
Detroit Stoker Co. of Canada, Ltd., Canada Bldg., Windsor, Ont.; Works at London, Ont.
DeVilbiss Co., The, 300 Phillips Ave., Toledo, O.
Devine Mfg. Co., Inc., J. P., 909 Shawnee Ave., Mt. Vernon, Ill.
Devlin Mfg. Co., Inc., Thomas, Burlington, N. J.
Dial Light Co. of America, Inc., 92 West St., New York, N. Y.
Diamond Chain & Mfg. Co., 400 Kentucky Ave., Indianapolis, Ind.
Diamond Chemical Products, 17 E. 48th St., New York, N. Y.
Diamond Expansion Bolt Co., Inc., 500 North Ave., Garwood, N. J.
Diamond Mfg. Co., 253 W. Eighth St., Wyoming, Pa.
Diamond Power Specialty Corp., 10340 Oakland, Detroit, Mich.
Diceler Corp., The, Greenville, Pa.
Dick Co., Inc., R. & J., 24-48 Sade St., Passaic, N. J.
Diehl Mfg. Co., Trumbull St., Elizabethport, N. J.
Dillon Co., 220-C E. Brady St., Tulsa, Okla.
Dillon Steam Boiler Wks., Inc., D. M., Crocker St., Fitchburg, Mass.
Dixon Crucible Co., Joseph, Wayne & Monmouth Sts., Jersey City, N. J.
Dockson Corp., 3847 Wabash Ave., Detroit, Mich.
Dockstader, S. E., 1128 Munsey Bldg., Washington, D. C.
Dodge Mfg. Corp., 500 S. Union St., Mishawaka, Ind.
Doheny Co., John J., 326 Lake St., Belmont, Mass.
Dole Valve Co., The, 1901-41 Carroll Ave., Chicago, Ill.
Domestic Engine & Pump Co., Shippensburg, Pa.
Dow Chemical Co., Midland, Mich.
Downingtown Iron Wks., Wallace Ave., Downingtown, Pa.
Downs-Smith Brass & Copper Co., 304-320 E. 45th St., New York, N. Y.
Dracco Corp., 4057 E. 116th St., Cleveland, O.
Dragert Co., Inc., C. H., 237 India St., Brooklyn, N. Y.
●Dravo Corp., Neville Island, Pittsburgh, Pa.
Drayer & Hanson, Inc., 738 E. Pico Blvd., Los Angeles, Cal.

● Advertisement in this issue. See Index to Advertisers, page 306.

Dreis & Krump Mfg. Co., 7404 Loomis Blvd., Chicago, Ill.
Dresser Mfg. Co., 490 Fisher Ave., Bradford, Pa.
Dry-Zero Corp., Merchandise Mart, Chicago, Ill.
Dual Air Fan Co., 711 W. Lake St., Chicago, Ill.
●Dunham Co., C. A., 450 E. Ohio St., Chicago, Ill.
Dunn, Inc., Struthers, 1332 Cherry St., Philadelphia, Pa.
du Pont de Nemours & Co., Inc., E. I., Fabrics & Finishes Dept., Wilmington, Del.
du Pont de Nemours & Co., E. I., National Ammonia Div., Wilmington, Del.
du Pont de Nemours & Co., E. I., National Ammonia Div., Wilmington, Del.
Durabla Mfg. Co., 114 Liberty St., New York, N. Y.
Durakool, Inc., 1010 N. Main St., Elkhart, Ind.
Duraloy Co., Scottdale, Pa.
Duriron Co., Inc., 450 N. Findlay St., Dayton, O.
Duro Co., 537 Monument Ave., Dayton, O.
Dustlix Corp., 715 N. Van Buren St., Milwaukee, Wis.
Dwyer Mfg. Co., F. W., 565 W. Washington Blvd., Chicago, Ill.
Dyer Welder & Engineering Co., 7 E. 19th St., Kansas City, Mo.

E

Eagle-Picher Lead Co., American Bldg., Cincinnati, O.
Earl Co., Warren, 3409 McKinney Ave., Houston, Tex.
Eastern Engineering Co., 45 Fox St., New Haven, Conn.
Eastern Foundry Co., Boyertown, Pa.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Eastern Oil & Equipment Co., Inc., 133 Marginal Way, Portland, Me.
Eastman Kodak Co., Kodak Park, Rochester, N. Y.
Eclipse Fuel Engineering Co., 707 S. Main St., Rockford, Ill.
Econocol Stoker Div. of Cotta Transmission Corp., 2340 11th St., Rockford, Ill.
Economy Electric Mfg. Co., 4606 W. 21st Pl., Chicago, Ill.
Economy Equipment Co., 223 N. Wolcott Ave., Chicago, Ill.
●Economy Pumps, Inc., 1000 Weller Ave., Hamilton, O.
Eddy Stoker Corp., 4717 W. North Ave., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edge Moor Iron Wks., Inc., 30 Rockefeller Plaza, New York, N. Y.
Edison General Electric Appliance Co., Inc., 5600 W. Taylor St., Chicago, Ill.
Edison, Inc., Thomas A., Instrument Div., Lakeside Ave., West Orange, N. J.
Edward Valve & Mfg. Co., Inc., 1200 W. 145th St., East Chicago, Ind.
Edwards Mfg. Co., Inc., 337 Eggleston Ave., Cincinnati, O.
Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Eiker Mfg. Co., Ogallala, Nebr.
Eisler Engineering Corp., 754 S. 13th St., Newark, N. J.
Elastic Stop Nut Corp., 2330 Vauxhall Rd., Union, N. J.
Electric Air Heater Co., Division of American Foundry Equipment Co., 619 S. Byrkit St., Mishawaka, Ind.
Electric Arc, Inc., 152 Jelliff Ave., Newark, N. J.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., Caledonia & Gillette Sts., La Crosse, Wis.
Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, O.
Electric Machinery Mfg. Co., 1331 Tyler St., N. E., Minneapolis, Minn.
Electric Valve Mfg. Co., Inc., 68 Murray St., New York, N. Y.
Electrimatic Corp., 2100 Indiana Ave., Chicago, Ill.
Electroaire Corp., 1455-57 W. Congress St., Chicago, Ill.
Electrogas Furnace Co., 255 Ninth St., San Francisco, Cal.
Electrol, Inc., 934 Main Ave., Clifton, N. J.
Electrovent Fan & Mfg. Co., 812 W. Lake St., Chicago, Ill.
Elgin Softener Corp., Elgin, Ill.
Elgo Shutter & Mfg. Co., 6970 W. Jefferson Ave., Detroit, Mich.
Elliott Co., Jeannette, Pa.
Ellis Drier Co., 2444 N. Crawford Ave., Chicago, Ill.
Ellison Draft Gage Co., 214 W. Kinzie St., Chicago, Ill.
●Ellsworth Pipe & Supply Co., 1739 W. St. Paul Ave., Milwaukee, Wis.
Elsey Metal Specialties Co., 1535 Spruce St., Detroit, Mich.
Emerson Electric Mfg. Co., The, 1847 Washington Ave., St. Louis, Mo.
Empire Sheet & Tin Plate Co., N. Bowman St., Mansfield, O.
Empire Ventilation Equipment Co., 35-39 Vernon Blvd., Long Island City, N. Y.
Endura Mfg. Corp., 45 N. 4th St., Quakerstown, Pa.
Engelhard, Inc., Charles, 90 Chestnut St., Newark, N. J.
Engineer Co., 75 West St., New York, N. Y.
Enterprise Engine & Foundry Co., 2949 18th St., San Francisco, Cal.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Ergolyte Mfg. Co., 3644 Lawrence St., Philadelphia, Pa.
Erie Bolt & Nut Co., Erie, Pa.
Erie City Iron Wks., 1450 East Ave., Erie, Pa.
Erie Tool Wks., 11th & French Sts., Erie, Pa.
Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles, Cal.
Eutectic Welding Alloys Co., 40 Worth St., New York, N. Y.
Everhot Products Co., 2059 W. Carroll, Chicago, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Everlasting Valve Co., 49 Fisk St., Jersey City, N. J.
Excelsior Leather Washer Mfg. Co., 720-730 Chestnut St., Rockford, Ill.
Excelsior Steel Furnace Co., 118 So. Clinton St., Chicago, Ill.
Excelsior Tool & Machine Co., 31st & Ridge Ave., East St. Louis, Ill.
Extruded Plastics, Inc., New Canaan Ave., Norwalk, Conn.

F

Fafnir Bearing Co., 37 Booth St., New Britain, Conn.
●Fairbanks Co., 393 Lafayette St., New York, N. Y.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Fairmont Aluminum Co., Fairmont, W. Va.
Fales Chemical Co., Inc., The, 545 Fifth Ave., New York, N. Y.
Falstrom Co., Main Ave. & D. L. & W. R. R., Passaic, N. J.
Faraday Engrg. Co., 56 Clearway St., Back Bay, Boston, Mass.
Farley Sleeve & Hanger Co., 3748 E. 71st St., Cleveland, O.
Farquhar Co., Ltd., A. B., Duke St., York, Pa.
Farrar & Trefts, 20 Milburn St., Buffalo, N. Y.
●Fedders Mfg. Co., Inc., 81 Tonawanda St., Buffalo, N. Y.
Federal Machine & Welder Co., 212 Dana St., Warren, O.
Federal-Mogul Corp., 11031 Shoemaker St., Detroit, Mich.
Fee & Mason Mfg. Co., Inc., 81 Beekman St., New York, N. Y.
Fee and Stemwedel, Inc., 2210 Wabansia Ave., Chicago, Ill.
Felt Products Mfg. Co., 1514 Carroll Ave., Chicago, Ill.
Felters Co., Inc., 210 South St., Boston, Mass.
Ferguson & Lange Foundry Co., 1039 Willow St., Chicago, Ill
Fern, Ralph, 2517 Boulevard Ave., Scranton, Pa.
Ferro-Enamel Corp., 4150 E. 56th St., Cleveland, O.
Ferro-Nil Corp., 381 Fourth Ave., New York, N. Y.
Field Control Div., H. D. Conkey & Co., Mendota, Ill.
Filtrine Mfg. Co., Inc., 53 Lexington Ave., Brooklyn, N. Y.
Fingles, Inc., W. A., Reistertown Rd. at Elgin Ave., Baltimore, Md.
Fireline Stove & Furnace Lining Co., 1800 Kingsbury St., Chicago, Ill.
Firemood Machine Wks., Converse, Ind.
Firestone Tire & Rubber Co., S. Main St., Akron, O.
Fir-Tex Insulating Board Co., St. Helens, Ore.
●Fisher Governor Co., 205 S. First Ave., Marshalltown, Ia.
●Fitzgibbons Boiler Co., Inc., 101 Park Ave., New York N. Y.
Flagg & Co., Inc., Stanley G., 1421 Chestnut St., Philadelphia, Pa.
Flemm Lead Co., Inc., Bradley Ave. & School St., Long Island City, N. Y.
Flexitallic Gasket Co., 8th & Bailey Sts., Camden, N. J.
Flexlock Corp., 411 E. Market St., Akron, O.
Flexo Supply Co., Inc., 4221 Olive St., St. Louis, Mo.
Flintkote Co., The, 30 Rockefeller Plaza, New York, N. Y.
●Flori Pipe Co., The, 601 E. Red Bud Ave., St. Louis, Mo.
Floridin Co., Warren, Pa.
Fluor Corp., Ltd., The, 2500 S. Atlantic Blvd., Los Angeles, Cal.
Flynn & Emrich Co., 301 Holliday St., Baltimore, Md.
Ford Roofing Products Co., 111 W. Washington St., Chicago, Ill.
Forman Air Conditioning & Engrg. Co., 345 W. 40th St., New York, N. Y.
Forslund Pump & Machinery Co., 1717-19 Main St., Kansas City, Mo.
Fossum, M. H., 2086 Marshall Ave., St. Paul, Minn.
Foster Engineering Co., 109 Monroe St., Newark, N. J.
Foster Pump Wks., Inc., 46-A Washington St., Brooklyn, N. Y.
Foster Wheeler Corp., 165 Broadway, New York, N. Y.
Fowler & Wolfe Radiator Co., Oak & Carson Sts., Norristown, Pa.
Fox Control & Mfg. Co., 3589 E. 93rd St., Cleveland, O.
Foxboro Co., 106 Neponset Ave., Foxboro, Mass.
France Packing Co., 6512 Tacony St., Tacony, Philadelphia, Pa
Frank Heaters, Inc., 150 Railroad Ave., Paterson, N. J.
●Frederick Iron & Steel Co., E. 7th St., Frederick, Md.
Fresh-'nd Air Co., 210 N. Clinton St., Chicago, Ill.
Fretz-Moon Tube Co., Inc., Butler, Pa.
Frick Co., Waynesboro, Pa.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Towson, Md.
Frigidaire Div., General Motors Corp., Dayton, O.
Frost Mfg. Co., S. Henderson St., Galesburg, Ill.
Fuel Savers, Inc., 15th & Herr Sts., Harrisburg, Pa.
Fulflo Specialties Co., Inc., The, Blanchester, O.
Fuller Co., 124 Bridge St., Catasauqua, Pa.
●Fulton Sylphon Co., The, Box 400, Knoxville, Tenn.
Furblo Co., Hermansville, Mich.

G

G. D. S. Machinery & Supply Co., Inc., 101 Walker St., New York, N. Y.
G. M. Mfg. Co., 50 W. 3rd St., New York, N. Y.
●G & O Mfg. Co., 138 Winchester Ave., New Haven, Conn.
Gale Products, Galesburg, Ill.
Gallaher Boiler Co., 3615 LaClede Ave., St. Louis, Mo.
Gallaher Co., The, Owatonna, Minn.
Garden City Fan Co., 332 S. Michigan Ave., Chicago, Ill.
Gardiner Metal Co., 2514 W. 48th Pl., Chicago, Ill.
Gardner-Denver Co., Quincy, Ill.
Garlock Packing Co., 50 Main St., Palmyra, N. Y.
Gasweld Equipment Div., Liquid Carbonic Corp., 625 W. Jackson Blvd., Chicago, Ill.
Gates Rubber Co., The, 999 S. Broadway, Denver, Colo.
Gatke Corp., 228 N. La Salle St., Chicago, Ill.
Gehl Bros. Mfg. Co., West Bend, Wis.
Gehri Co., 1117 Tacoma Ave., Tacoma, Wash.
General Air Conditioning Corp., 4411 Appleton St., Cincinnati, O.

● Advertisement in this issue. See Index to Advertisers, page 306.

General Aire Co., 118 N. Sixth St., Philadelphia, Pa.
General Blower Co., Inc., 5335 Market St., Philadelphia, Pa.
General Blower Corp., 1450 Army St., San Francisco, Cal.
General Ceramics Co., Keasbey, N. J.
●General Controls Co., 801 Allen Ave., Glendale, Cal.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., 5 Lawrence St., Bloomfield, N. J.
General Electric Co., Lamp Dept., Nela Park, Cleveland, O.
General Electric Co., Plastics Div., 1 Plastics Ave., Pittsfield, Mass.
●General Electric Co., 1 River Rd., Schenectady, N. Y.
General Equipment Co., 315 S. Wichita, Wichita, Kans.
General Fittings Co., 123 Georgia Ave., Providence, R. I.
General Furnaces Corp., 90 Broad St., New York, N. Y.
General Gas Light Co., 212 N. Park, Kalamazoo, Mich.
General Insulating Products Co., 8821 15th Ave., Brooklyn, N. Y.
General Machinery Co., 3500 Riverside Ave., Spokane, Wash.
General Motors Corp., Detroit, Mich.
General Motors Corp., Moraine Products Div., Dayton, O.
General Plate Div., Metals & Controls Corp., 34 Forest St., Attleboro, Mass.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
General Sales & Products Co., 242 Saratoga St., Cohoes, N. Y.
Gerett Corp., M. A., 2947 N. 30th St., Milwaukee, Wis.
Gerstein & Cooper Co., 1 W. Third St., South Boston, Mass.
Geuder, Paeschke & Frey Co., W. St. Paul Ave. and N. 15th St., Milwaukee, Wis.
Giant Grip Mfg. Co., 30 Osceola St., Oshkosh, Wis.
Giant Mfg. Co., South Ave., Council Bluffs, Ia.
Gilbert & Barker Mfg. Co., West Springfield, Mass.
Gillian Mfg. Co., 7752 Dubois St., Detroit, Mich.
Gilmer Company, L. H., 7230 Keystone St., Tacony, Philadelphia, Pa.
Gisholt Machine Co., 11 S. Baldwin St., Madison, Wis.
Glaser Lead Co., Inc., 31 Wyckoff Ave., Brooklyn, N. Y.
Gleason-Avery, Inc., 27 Clark St., Auburn, N. Y.
Glidden Co., 11001 Madison Ave., Cleveland, O.
Globe Machine & Stamping Co., 1220 W. 76th St., Cleveland, O.
Globe Steel Tubes Co., 3839 W. Burnham St., Milwaukee, Wis.
Glore Sales Corp., Evins F., 1939 Grand Central Terminal Bldg., New York, N. Y.
Goese Mfg. Co., 2548 N. 18th St., Milwaukee, Wis.
Goethel Co., Alfred C., 2337 N. 31st St., Milwaukee, Wis.
Goethel Sheet Metal Wks., Alfred, 1910 N. Killian Pl., Milwaukee, Wis.
Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J.
Golden-Anderson Valve Specialty Co., Fulton Bldg., Pittsburgh, Pa.
Goldens' Foundry & Machine Co., Columbus, Ga.
Goodrich Co., B. F., 548 S. Main St., Akron, O.
Goodyear Tire & Rubber Co., E. Market St., Akron, O.
Gorton Heating Corp., Cranford, N. J.
Goulds Pumps, Inc., Fall St., Seneca Falls, N. Y.
Governair Corp., 605 W. Main St., Oklahoma City, Okla.
Grabler Mfg. Co., 6565 Broadway, Cleveland, O.
Graham Transmissions, Inc., 2706 N. Teutonia Ave., Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., 525-28 Monroe Ave., Grand Rapids, Mich.
Grand Rapids Die & Tool Co., 113-117 Michigan St., Grand Rapids, Mich.
Granite City Steel Co., 20th & Madison Ave., Granite City, Ill.
●Grant Wilson, Inc., 4115 W. Taylor St., Chicago, Ill.
Graton & Knight Co., 356 Franklin St., Worcester, Mass.
Graver Tank & Mfg. Co., Inc., 4809 Todd Ave., East Chicago, Ind.
Gray Metal Products, Inc., Rochester, N. Y.
Great Lakes Steel Corp., Ecorse, Detroit, Mich.
Great National Air Conditioning Corp., 1305-9 S. Lamar St., Dallas, Tex.
Green Fire Brick Co., A. P., Mexico, Mo.
Greene, Tweed & Co., 4377 Bronx Blvd., New York, N. Y.
Greenfield Tap & Die Corp., Sanderson St., Greenfield, Mass.
Greenlee Tool Co., 2136 12th St., Rockford, Ill.
Grief, Edward C., 64 West End Ave., Bogota, N. J.
●Grinnell Co., Inc., 260 W. Exchange, Providence, R. I.
Grinnell Co., Inc., Superseal Div., 260 W. Exchange St., Providence, R. I.
Griscom-Russell Co., The, 285 Madison Ave., New York, N. Y.
Grobet File Corp. of America, 3 Park Pl., New York, N. Y.
Grove Regulator Co., 1190 67th St., Oakland, Cal.
Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago, Ill.
Guardian Utilities Co., 215 E. Michigan St., Michigan City, Ind.
Guild & Garrison, Inc., 43 Keap St., Brooklyn, N. Y.
Guth Co., Edwin F., 2615 Washington Blvd., St. Louis, Mo.
Gylstrom Co., O., 108 W. Wells St., Milwaukee, Wis.

H

H-B Instrument Co., 2518 N. Broad St., Philadelphia, Pa.
H. & B. Sales Co., Ltd., 2875 Cherry Ave., Long Beach, Cal.
Haering Co., Inc., D. W., 205 W. Wacker Dr., Chicago, Ill.
Hagan Corp., 600 Bowman Bldg., Pittsburgh, Pa.
Hague & Co., Inc., Alfred, 227 Thirty-fourth St., Brooklyn, N. Y.
●Haines & Co., William S., 12th & Buttonwood Sts., Philadelphia, Pa.
Hall Mfg. Co., Cedar Rapids, Ia.
Halowax Products Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Hamburg Boiler Wks., Inc., Grand St., Hamburg, Pa.
Hamilton Rubber Mfg. Co., Mead St., Trenton, N. J.
Hammett Electric Mfg. Co., 209 W. 19th Ter., Kansas City, Mo.
Hammond Brass Wks., Summer Blvd., Hammond, Ind.
Hampton-Cross Co., The, 1014 W. Main St., Louisville, Ky.
Hampton Electric Mfg. Co., Third and Archie Sts., Oakmont, Pittsburgh, Pa.
Hancock Valve Div., Manning, Maxwell & Moore Inc., 11 Elias St., Bridgeport, Conn.
Handley Brown Heater Co., Jackson, Mich.
Handy & Harman, 82 Fulton St., New York, N. Y.
Hanlon-Waters, Inc., National Bank of Tulsa Bldg., Tulsa, Okla.
Hardinge Oil Burner & Mfg. Co., 1770 Berteau St., Chicago, Ill.
Hardy, Inc., Charles, 420 Lexington Ave., New York, N. Y.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.
Harrington & King Perforating Co., 5655 Fillmore St., Chicago, Ill.
Harris, A. R., 4546 Hohman Ave., Hammond, Ind.
Harris Calorific Co., The, 5501 Cass Ave., N. W., Cleveland, O.
Harris & Co., Arthur, 210 N. Aberdeen St., Chicago, Ill.
Harrisburg Machinery Corp., 7th & Curtin St., Harrisburg, Pa.
Harrisburg Steel Corp., 10th & Herr Sts., Harrisburg, Pa.
Harry Cooling Towers, Inc, 554 W. 48th St., New York, N. Y.
Hart & Cooley Mfg. Co., Holland, Mich.
Hart Mfg. Co., The, Hamilton St., Hartford, Conn.
Hartmann Co., Chas., 985 Dean St., Brooklyn, N. Y.
Hartzell Propeller Fan Co., P. O. Box 909, Roosevelt Ave., Piqua, O.
Harvey-Whipple, Inc., Springfield, Mass.
Hasco Valve & Machine Co., 1819 W. St. Paul Ave., Milwaukee, Wis.
Haskell Mfg. Co., Wm. H., 20 Commerce St., Pawtucket, R. I.
Hastings Air Conditioning Co., Box 481, 108 S. Colorado Ave., Hastings, Nebr.
Haveg Corp., Newark, Del.
●Hays Corp., E. 8th St., Michigan City, Ind.
Hays Mfg. Co., 801 W. 12th St., Erie, Pa.
Healy Ruff Co., 765 Hampden Ave., St. Paul, Minn.
Heartley Machine & Tool Co., 900-8 Summit St., Toledo, O.
Heat Transfer Products, Inc., 90 West St., New York, N. Y.
Heating Assurance, Inc., 124 E. Augusta St., Spokane, Wash.
Hegeler Zinc Co., P. O. Box 599, Danville, Ill.
Hendley & Whittemore, 6 Blackhawk Blvd., Beloit, Wis.
Hendrick Mfg. Co., 37 Dundaff St., Carbondale, Pa.
Henry Furnace & Foundry Co., 3480 E. 49th St., Cleveland, O.
●Henry Valve Co., 1019 N. Spaulding Ave., Chicago, Ill.
Henry & Wright Mfg. Co., 760 Windsor St., Hartford, Conn.
Herbert Boiler Co., 2300 Bloomingdale Ave., Chicago, Ill.
Her-Born Engineering & Mfg. Co., 212 Columbus Ave., Sandusky, O.
Herbusch Corp., The, 706 Chestnut St., 210 Title Guaranty Bldg., St. Louis, Mo.
Hercules Chemical Co., Inc., 332 Canal St., New York, N. Y.
Hercules Float Wks., 200 Franklin St., Springfield, Mass.
Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.
Hess Warming & Ventilating Co., 1211 S. Western Ave., Chicago, Ill.
Hetzel Roofing Products Co., 67 Maine St., Newark, N. J.
Higgin Products, Inc., Newport, Ky.
Highside Chemicals Co., 195 Verona Ave., Newark, N. J.
Hill Diesel Engine Co., Lansing, Mich.
Hill, E. Vernon, 6826 W. Highland Ave., Chicago, Ill.
Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y.
Hinde & Dauch Paper Co., P.O. Box 861, Sandusky, O.
Hirschman Co., W. F., 1245 McKinley Parkway, Buffalo, N. Y.
Hobart Bros. Co., Troy, O.
Hodge Boiler Wks., Summer St., East Boston, Mass.
●Hodgman Mfg. Co., 135 Washington St., Taunton, Mass.
Hodgman Rubber Co., Framingham, Mass.
Hoffman Combustion Engineering Co., 710 Marquette Bldg., Detroit, Mich.
●Hoffman Specialty Co., 1001 York St., Indianapolis, Ind.
Holcomb & Hoke Mfg. Co., 1545 Van Buren, Indianapolis, Ind.
Hollands Mfg. Co., Erie, Pa.
Hollup Corp., Div. of National Cylinder Gas Co., 3357 W. 47th Pl., Chicago, Ill.
Holsclaw Bros., Inc., Evansville, Ind.
Holtum Mfg. Co., Freeport, Ill.
Holtzer-Cabot Electric Co., 125 Amory St., Boston, Mass.
Homestead Valve Mfg. Co., P. O. Box 348, Coraopolis, Pa.
Hoppes Mfg. Co., 850 N. Belmont Ave., Springfield, O.
Horn Co., A. C., 43-36 Tenth St., Long Island City, N. Y.
Horton Mfg. Co., 3016 University Ave., S. E., Minneapolis, Minn.
Hossfeld Mfg. Co., 460 W. Third St., Winona, Minn.
Hotstream Heater Co., 8007 Grand Ave., Cleveland, O.
Hough Shade Corp., 1095 Jackson St., Janesville, Wis.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Hound Packing Co., 4757 E. Ravenswood Ave., Chicago, Ill.
Howard Iron Wks. & Alberger Heater Co., 287 Chicago St., Buffalo, N. Y.
Howe Ice Machine Co., 2825 Montrose Ave., Chicago, Ill.

● Advertisement in this issue. See Index to Advertisers, page 306.

Howell Electric Motors Co., Howell, Mich.
Howes-Woods Co., 201 Bridge St., Cambridge, Mass.
Hubbell Corp., 1315 W. Carroll Ave., Chicago, Ill.
Hugo Mfg. Co., 49th Ave., W., & Superior St., West Duluth, Minn.
Hunt & Son, C. B., Salem, O.
Hunter Fan & Ventilating Co., Inc., 714 Sterick Bldg., Memphis, Tenn.
●Hussey & Co., C. G., 2850 Second Ave., Pittsburgh, Pa.
Huyette Co., Inc., Paul B., 401 N. Broad St., Philadelphia, Pa.
Hyatt Bearings Div., General Motors Corp., Harrison, N. J.
Hynes Electric Heating Co., West and Clinton Sts., Camden, N. J.

I

Ice Cooling Appliance Corp., Morrison, Ill.
Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, O.
Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.
●Illinois Engineering Co., 2035 S. Racine Ave., Chicago, Ill.
Illinois Iron & Bolt Co., 918 S. Michigan Ave., Chicago, Ill.
Illinois Malleable Iron Co., 1801 Diversey Parkway, Chicago, Ill.
Illinois Oil Co., 4th Ave. and 24th St., Rock Island, Ill.
●Illinois Testing Laboratories, 420 N. La Salle St., Chicago, Ill.
Illinois Zinc Co., 2959 W. 47th St., Chicago, Ill.
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Imperial Electric Co., 64 Ira Ave., Akron, O.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
Independent Register Co., 3747 E. 93rd St., Cleveland, O.
Indian Trailer Corp., Koolroom Div., 2338 Indiana Ave., Chicago, Ill.
Industrial Engineering Corp., Terre Haute, Ind.
Industrial Lock Nut Co., South Hanover, Mass.
Industrial Mfg. & Engineering Co., 3845 N. Ravenswood Ave., Chicago, Ill.
Industrial Research, Lansdowne, Pa.
Industrial Service Laboratories, 7656 W. Forest Home Ave., Milwaukee, Wis.
Industrial Sheet Metal Wks., Inc., 628 E. Forest Ave., Detroit, Mich.
Ingersoll Steel & Disc Div., Borg-Warner Corp., 310 S. Michigan Ave., Chicago, Ill.
Ingersoll-Rand, 11 Broadway, New York, N. Y.
Inland Mfg. Co., 1120 N. Cicero Ave., Chicago, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Inner-Tite Clamp Corp., 18 W. Jersey St., Elizabeth, N. J.
Insto-Gas Corp., 1900 E. Jefferson, Detroit, Mich.
Insulite Div. Minnesota and Ontario Paper Co., 1100 Builders Exchange Bldg., Minneapolis, Minn.
Insul-Wool Insulation Corp., Wichita, Kans.
Inter-Coastal Paint Corp., 15th St., and Southern R. R., East St. Louis, Ill.
International Boiler Works, East Stroudsburg, Pa.
International Correspondence Schools, Scranton, Pa.
International Engineering, Inc., 1145 Bolander Ave., Dayton, O.
International Engineering Wks., Inc., Box 71, Framingham, Mass.
International Exposition Co., Grand Central Palace, New York, N. Y.
International Heater Co., 101 Park Ave., Utica, N. Y.
International Moistening Co., 489 S. Main St., Providence, R. I.
●International Nickel Co., 67 Wall St., New York, N. Y.
International Nutyp Tool Co., 68 W. First St., Oswego, N. Y.
International Register Co., 2620 W. Washington Blvd., Chicago, Ill.
International Steel Co., 1545 Edgar St., Evansville, Ind.
International Vermiculite Co., 11th & Stanford Ave., Springfield, Ill.
Iona Ventilator Co., Inc., 2821-29 W. Dauphin St., Philadelphia, Pa.
Iowa Paint Mfg. Co., 118-20 Eighth St., Des Moines, Ia.
Iron Fireman Mfg. Co., 3121 W. 106 St., Cleveland, O.
Iwan Brothers, 1503 Prairie Ave., South Bend, Ind.

J

Jabsco Pump Co., 8306 Wilshire Blvd., Beverly Hills, Cal.
Jackson Co., Byron, P. O. Box 2017, Terminal Annex, Los Angeles, Cal.
Jackson & Church Co., 321 N. Hamilton Ave., Saginaw, Mich.
Jacobs Co., B. & J., 1729 John St., Cincinnati, O.
Jaden Mfg. Co., Inc., F., 1601 Second St., Hastings, Nebr.
Jamar Co., Walker, 367 S. First Ave., E. Duluth, Minn.
Jamieson Mfg. Co., 820 Eagle Ford Rd., Dallas, Tex.
Janette Mfg. Co., 556 W. Monroe St., Chicago, Ill.
Jarecki Mfg. Co., 1345 W. 12th St., Erie, Pa.
Jefferson Electric Co., 25th & Madison St., Bellwood, Ill.
Jefferson Union Co., Sales Office, 601 W. 26th St., New York, N. Y.; Factory, Lexington, Mass.
Jefferson Union Co., Inc., Lockport, N. Y.
Jeffrey Mfg. Co., 859-99 N. Fourth St., Columbus, O.
●Jenkins Bros., 80 White St., New York, N. Y.
Jennison Co., 17 Putnam St., Fitchburg, Mass.
Jessop Steel Co., Washington, Pa.
●Jewel Mfg. Co., 1841 University Ave., St. Paul, Minn.
Joal Mfg. Corp., 2058 Canton St., Toledo, O.
●Johns-Manville, 22 E. 40th St., New York, N. Y.
Johnson Bronze Co., 460 S. Mill St., New Castle, Pa.
Johnson Co., Lloyd S., 2241 Indiana Ave., Chicago, Ill.
Johnson Co., S. T., 940 Arlington St., Oakland, Cal.; 401 N Broad St., Philadelphia, Pa.
Johnson Corp., 892 Wood St., Three Rivers, Mich.
Johnson Fan & Blower Corp., 1320 W. Lake St., Chicago, Ill.
Johnson Gas Appliance Co., 520 "E" Ave., N. W., Cedar Rapids, Ia.
Johnson Mfg. Co., 10th & Sycamore, Waterloo, Ia.
●Johnson Service Co., 507 E. Michigan St., Milwaukee, Wis.
Johnston Bros., Inc., Ferrysburg, Mich.
Johnston & Chapman Co., 2925 Carroll Ave., Chicago, Ill.
Johnston Co., William W., 115 Bayard St., Dayton, O.
Johnston Tin Foil & Metal Co., 6100 S. Broadway, St. Louis, Mo.
Jones Foundry & Machine Co., W. A., 4401 Roosevelt Rd., Chicago, Ill.
Jones & Laughlin Steel Corp., Third Ave. & Ross St., Pittsburgh, Pa.
Jordan & Co., Paul R., 631 S. Delaware St., Indianapolis, Ind.
Justus Steam Trap Co., Napanoch, N. Y.

K

Kainer & Co., 763 W. Lexington St., Chicago, Ill.
Kaiser Co., H. S., 3336 Franklin Blvd., Chicago, Ill.
Kane Mfg. Corp., Kane, Pa.
Kauffman Air Conditioning Corp., 4336 W. Pine Blvd., St Louis, Mo.
Kaufman, H. J., 13215 Roselawn Ave., Detroit, Mich.
Kaye & MacDonald, Inc., 92 Franklin Ave., West Orange, N. J
Keasbey Co., Robert A., 139-149 W. 19th St., New York, N. Y
Keasbey & Mattison Co., Butler Ave., Ambler, Pa.
Keckley Co., O. C., 400 W. Madison St., Chicago, Ill.
Keeler Co., E., 238 West St., Williamsport, Pa.
Keeney Mfg. Co., Main St., Newington, Conn.
Kehm Corp., The, 441 N. La Salle St., Chicago, Ill.
Keldur Corp., 420 Lexington Ave., New York, N. Y.
Kellogg Co., M. W., The, 225 Broadway, New York, N. Y.
Kelly-Koet, Covington, Ky.
Kelvin-White Co., 90 State St., Boston, Mass.
Kelvinator Div., Nash-Kelvinator Corp., 14250 Plymouth Rd., Detroit, Mich.
Kennard, Inc., Sam, 3331-3339 Market St., St. Louis, Mo.
Kennedy, Inc., David E., 60 Second Ave., Brooklyn, N. Y.
Kennedy Valve Mfg. Co., The, Elmira, N. Y.
Kerentoff, G. L., 2218 Reading Rd., Cincinnati, O.
Kernchen Co., 103 E. Wacker Drive, Chicago, Ill.
Kerotest Mfg. Co., 2525 Liberty Ave., Pittsburgh, Pa.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
●Kewanee Boiler Corp., Franklin St. and "Q" Tracks, Kewanee Ill.
Key Co., 2700 McCasland, East St. Louis, Ill.
Keystone Asphalt Products Co., 43 E. Ohio St., Chicago, Ill.
Keystone Carbon Co., Inc., St. Marys, Pa.
Kidder Mfg. Co., Inc., J. F., 426 Colchester Ave., Burlington, Vt.
●Kieley & Mueller, Inc., 2013-2033 43rd St., North Bergen, N. J.
Kimball-Krogh Pump Div., Food Machinery Corp., 301 West Ave. 26, Los Angeles, Cal.
Kimberly-Clark Corp., Neenah, Wis.
Kinetic Chemicals, Inc., 10th & Market St., Wilmington, Del
King Engineering Corp., 943 Willard Ave., Ann Arbor, Mich.
King Union Co., Inc., Hillsgrove, R. I.
King Ventilating Co., Box 178, Owatonna, Minn.
Kingsford Foundry & Machine Wks., 264 W. Second St., Oswego, N. Y.
Kingston Products Corp., 1415 N. Webster, Kokomo, Ind.
Kinney Mfg. Co., 3529 Washington St., Boston, Mass.
Kirk & Blum Mfg. Co., 2838-52 Spring Grove Ave., Cincinnati, O.
Kisco Boiler & Engineering Co., 3732 Chouteau Ave., St Louis, Mo.
Klauer Mfg. Co., 9th and Washington Sts., Dubuque, Ia.
Klee Co., Geo. B., 1056-58 Hulbert Ave., Cincinnati, O.
Kleenaire Corp., 409 Jefferson St., Stevens Point, Wis.
Klingerit, Inc., 16-22 Hudson St., New York, N. Y.
Klipfel Mfg. Co., 2651 W. Harrison St., Chicago, Ill.
Kluegel & Co., E., 187 W. Kellogg Blvd., St. Paul, Minn.
Knickerbocker Co., 603 Liberty St., Jackson, Mich.
Knight, Maurice A., Kelley Ave., Akron, O.
Knowles Mushroom Ventilator Co., 11 Label St., Montclair, N. J.
Kohler Co., Kohler, Wis.
Kol-Master Corp., Oregon, Ill.
Kopperman & Sons, Joseph, 316 New St., Philadelphia, Pa.
Koppers Co., Bartlett Hayward Div., 200 Scott St., Baltimore, Md.

● Advertisement in this issue. See Index to Advertisers, page 306.

Korfund Co., 48-15 32nd Pl., Long Island City, N. Y.
Keven & Bro., L. O., Inc., 154 Ogden Ave., Jersey City, N. J.
Kraissl Co., Inc., The, Terhune and Williams Aves., Hackensack N. J.
●Kramer Trenton Co., 626 Brunswick Ave., Trenton, N. J.
Krehbiel Co., J. H., 425 N. Crawford Ave., Chicago, Ill.
Krez Co., Paul J., 444 N. LaSalle St., Chicago, Ill.
Kuhlman Electric Co., Detroit Electric Furnace Div., Bay City, Mich.
Kuhns Bros. Co., 1800 McCall St., Dayton, O.
Kunkle Valve Co., 121 N. Clinton St., Ft. Wayne, Ind.
Kwikon Co, 626 W. Jackson Blvd., Chicago, Ill.

L

La Bour Co., Inc., The, 1301 Sterling Ave., Elkhart, Ind.
Laclede-Christy Clay Products Co., 411 N. Seventh St., St. Louis, Mo.
Laclede Steel Co., Arcade Bldg., Rm. 1317, St. Louis, Mo.
Laclede Stoker Co., 4438 Hunt Ave., St. Louis, Mo.
La Crosse Steel Roofing & Corrugating Co., 300 S. Third St., La Crosse, Wis.
La Crosse Tractor Co., La Crosse, Wis.
Lammert & Mann Co., 281 N. Wood St., Chicago, Ill.
Lamneck Products, Inc., 1025 Lamneck St., Middletown, O.
Lamson & Sessions Co., 1971 W. 85th St., Cleveland, O.
Landis Machine Co., Inc., 5th & Church Sts., Waynesboro, Pa.
Larkin Coils, Inc., 519 Memorial Dr., S. E., Atlanta, Ga.
Larkin Packer Co., 6200 Maple Ave., St. Louis, Mo.
Lastik Products Co., Inc., 1106 Keenan Bldg., Pittsburgh, Pa.
Lau Blower Co., 2001 Home Ave., Dayton, O.
Lawler Automatic Controls, Inc., 453 N. MacQuesten Pkwy., Mount Vernon, N. Y.
Lawrence Pump & Engine Co., P. O. Box 70, Lawrence, Mass.
Layne & Bowler, Inc., University and Chelsea, Memphis, Tenn.
Lead Lined Iron Pipe Co., 1 Broadway, Wakefield, Mass.
Leavitt Machine Co., East River St., Orange, Mass.
Lecourtenay Co., 5 Maine St., Newark, N. J.
Lee Engineering Co., Union National Bank Bldg., Youngstown, O.
Lee Co., K. O., Aberdeen, S. D.
Lee & Son Co., Thomas, 128-132 W. Second St., Cincinnati, O.
Leeds & Northrup Co., 4970 Stenton Ave., Philadelphia, Pa.
Leffel & Co., James, 426 East St., Springfield, O.
Lehigh Fan & Blower Co., Front & Linden Sts., Allentown, Pa.
Lehon Co., 4411 S. Oakley Ave., Chicago, Ill.
Leinweber Fan & Blower Co., 8448 Crandon, Chicago, Ill.
Leland Electric Co., 1501 Webster St., Dayton, O.
Lennox Furnace Co., Marshalltown, Ia., Syracuse, N. Y., and Columbus, O.
Leonard Valve Company, Elmwood Station, Providence, R. I.
Leslie Co., Valley Brook & Grant Aves., Lyndhurst, N. J.
Leslie Welding Co., 2943 Carroll Ave., Chicago, Ill.
Levow, David, 308 W. 20th St., New York, N. Y.
Lewellen Mfg. Co., Columbus, Ind.
Lewin-Mathes Co., Lewin Metals Div., 12th and Chateau Sts., St. Louis, Mo.
Lewis & Co., Inc., Chas. S., 2207 Pine St., St. Louis, Mo.
Leyman Mfg. Corp., John H. McGowan Co. Div., 1416 First National Bank Bldg., Cincinnati, O.
Libbey-Owens-Ford Glass Co., Nicholas Bldg., Toledo, O.
●Lilie-Hoffman Cooling Towers, Inc., 4239 Duncan Ave., St. Louis Mo.
Limbert & Co., Geo. B., 570 Fulton St., Chicago, Ill.
Lincoln Electric Co., 12818 Coit Rd., Cleveland, O.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Linear Packing & Rubber Co., Inc., N. W. Cor. State Rd. & Levick St., Philadelphia, Pa.
Link-Belt Co., 307 N. Michigan Ave., 300 W. Pershing Rd., and 2410 W. 18th St., Chicago, Ill.; 519 N. Holmes Ave., and 220 S. Belmont Ave., Indianapolis, Ind.; 2045 W. Hunting Park Ave., Philadelphia, Pa.
Lintern Co., Berea, O.
Lion Mfg. Corp., 2701-11 Belmont Ave., Chicago, Ill.
Liquid Carbonic Corp., 3100 S. Kedzie Ave., Chicago, Ill.
Liquidometer Corp., 37-15 Skillman Ave., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, 23-01 Borden Ave., Long Island City, N. Y.
●Little Mfg. Co., M. S., 151 New Park Ave., Hartford, Conn.
Littleford Bros., 421 E. Pearl St., Cincinnati, O.
Locke Regulator Co., 76 North St., Salem, Mass.
Lockformer Co., The, 4615 Arthington St., Chicago, Ill.
Lockjoint Wood Products Co., 1721 Mildred St., Wichita, Kans.
Locknut Corp. of America, 3403 W. 47th St., Chicago, Ill.
Logan Engineering Co., Lawrence & Lamon Ave., Chicago, Ill.
Lohman Co., Wm. J., 1206 S. Grove St., Irvington, N. J.
Lonergan Co., J. E., 211 Race St., Philadelphia, Pa.
Long Mfg., Div. Borg-Warner Corp., 12501 Dequindre St., Detroit, Mich.
Lonn Mfg. Co., Inc., 500 N. Dearborn St., Chicago, Ill.
Lookout Boiler & Mfg. Co., Compress St. & Mfrs. Rd., Chattanooga, Tenn.
Lord Mfg. Co., 1633 W. 12th St., Erie, Pa.
Lovejoy Flexible Coupling Co., 5024 W. Lake St., Chicago, Ill.
Lowell Air Conditioning Corp., Otis Bldg., Philadelphia, Pa.
Lowell Wrench Co., 54 Commercial St., Worcester, Mass.
Loyal Knight Stokers, Inc., 800 Scheel St., Belleville, Ill.
Ludlow Valve Mfg. Co., Inc., Foot of Adams St., Troy, N. Y.
Lukens Steel Co., 308 S. First Ave., Coatesville, Pa.
Lumsden & Van Stone Co., 426 First St., South Boston, Mass.
Lunkenheimer Co., Waverly & Beekman Sts., Cincinnati, O.
Luzerne Rubber Co., Muirhead Ave., Trenton, N. J.
Lynch Mfg. Corp., Defiance, O.
Lynchburg Foundry Co., Peoples Bank Bldg., Lynchburg, Va.
Lyon, Conklin & Co., Inc., McComas & Race Sts., Baltimore, Md.

M

Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.
Macksons Co., 125 Cedar St., New York, N. Y.
MacLean-Fogg Lock Nut Co., 2653 N. Kildare, Chicago, Ill.
Magirl Foundry & Furnace Wks., P. H., 401-413 E. Oakland Ave., Bloomington, Ill.
Magnet Switch Co., 340 W. Huron St., Chicago, Ill.
Mahon Co., R. C., 8650 Mt. Elliott Ave., Detroit, Mich.
Maid-O'-Mist, Inc., 215 N. Aberdeen St., Chicago, Ill.
Maintenance Engineering Corp., 3611 Clinton Dr., Houston, Tex.
Majestic Co., 733 Erie St., Huntington, Ind.
Major Controls Sales Div., 12 Norfolk St., Cambridge, Mass.
Mall Tool Co., 7740 S. Chicago Ave., Chicago, Ill.
Malleable Iron Fittings Co., Branford, Conn.
Mallory Sales Co., 13904 Lincoln Ave., Dolton, Ill.
Manhattan Perforated Metal Co., Inc., 43-17 37th St., Long Island City, N. Y.
Manhattan Rubber Mfg., Div. of Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.
Manitowoc Boiler Wks., 16th & The River, Manitowoc, Wis.
Manley Products Corp., State & Hay Sts., York, Pa.
Manufacturers Fin Coil Co., 2505 S. Pulaski Rd., Chicago Ill.
Manufacturers Machine Co., Railroad Ave., North Andover, Mass.
Maple Valley Mfg. Co., First St., Mapleton, Ia.
Maplewood Machinery Co., Inc., 2634 Fullerton Ave., Chicago, Ill.
Marathon Electric Mfg. Corp., 131 W. Washington St., P.O. Box 298, Wausau, Wis.
Marble-Card Electric Co., Gladstone, Mich.
Marblehead Lime Co., 160 N. LaSalle St., Chicago, Ill.
Marion Machine, Foundry & Supply Co., P. O. Box 685, 3rd and Big Four Ry., Marion, Ind.
●Marley Co., 3001 Fairfax Rd., Kansas City, Kans.
Marlin-Rockwell Corp., Jamestown, N. Y.
●Marlo Coil Co., 6135 Manchester Ave., St. Louis, Mo.
Marquette Mfg. Co., 401 Johnson St., Minneapolis, Minn.
Marsh Corp., Jas. P., 2073 Southport Ave., Chicago, Ill.
Marsh Tritrol Co., 600 S. Michigan Ave., Chicago, Ill.
Marsh Valve Co., 4th St. & Brigham Rd., Dunkirk, N. Y.
Marshalltown Mfg. Co., 901 E. Nevada, Marshalltown, Ia.
Martens & Stormoen, 15 Hathaway St., Boston, Mass.
Martin, J. O. & C. U., 637 Minna St., San Francisco, Cal.
Martin Metal Mfg. Co., 900 E. Second St., Wichita, Kans.
Martin & Sons, H. P., 801 W. 12th St., Owensboro, Ky.
Martocello & Co., Jos. A., 229 N. 13th St., Philadelphia, Pa.
Mason-Neilan Regulator Co., 1190 Adams St., Boston, Mass.
Masonite Corp., 111 W. Washington St., Chicago, Ill.
Master Electric Co., 126 Davis Ave., Dayton, O.
Matthiessen & Hegeler Zinc Co., 9th & Sterling Sts., La Salle, Ill.
Mauck Seamless Copper Tank Corp., Victor, 309 E. Main, Norristown, Pa.
Maurath, Inc., 7309 Union Ave., Cleveland, O.
●May Oil Burner Corp., Maryland Ave. and Oliver, Baltimore, Md.
Mayflower Air-Conditioners, Inc., 5th Floor, Finch Ind. Bldg., St. Paul, Minn.
Mayson Mfg. Co., Inc., 4332 Horatio St., Detroit, Mich.
Maysteel Products, Inc., Horicon St., Mayville, Wis.
McAlear Mfg. Co., 1901-1909 S. Western Ave., Chicago, Ill.
McAuley Trap Co., 405 Penn Ave., Pittsburgh, Pa.
McCann Furnace Co., 5005 Euclid Ave., Cleveland, O.
●McCord Radiator & Mfg. Co., 2587 E. Grand Blvd., Detroit, Mich.
McCorkle Co., D. H., 6th & Bancroft Way, Berkeley, Cal.
●McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill.
McKay Co., York, Pa.
McLeod & Henry Co., Inc., Troy, N. Y.
McLouth Air Conditioning Corp., 2400 E. Michigan Ave., Lansing, Mich.
McPherson Furnace & Supply Co., 1805 N. E. Second Ave., Portland, Ore.
●McQuay, Inc., 1600 Broadway, N. E., Minneapolis, Minn.
McQuay-Norris Mfg. Co., Southwest Ave. at Marconi, St. Louis, Mo.
McWane Cast Iron Pipe Co., 1201 Vanderbilt Rd., Birmingham, Ala.

● Advertisement in this issue. See Index to Advertisers, page 306.

Mears-Kane-Ofeldt, Inc., 1903-1915 E. Hagert St., Philadelphia, Pa.
Medart Co., 3500 DeKalb, St. Louis, Mo.
Meier Electric & Machine Co., 3525 E. Washington St., Indianapolis, Ind.
Mellish & Murray Co., 1715 Carroll Ave., Chicago, Ill.
Merchant & Evans Co., 2035 Washington Ave., Philadelphia, Pa.
●Mereold Corp., The, 4201 Belmont Ave., Chicago, Ill.
Merco-Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Mercury Clutch Corp., 637 W. Third St., Massillon, O.
Meriam Co., The, 1985 W. 112th St., Cleveland, O.
Merrell Mfg. Co., 644 Curtis St., Toledo, O.
Metal Products Fabricating Co., 119 Kansas St., San Francisco, Cal.
Metal & Thermit Corp., 120 Broadway, New York, N. Y.
Metallo Gasket Co., 16 Bethany St., New Brunswick, N. J.
Metropolitan Refining Co., Inc., 23-28 50th Ave., Long Island City, N. Y.
Mettler Co., Lee B., 406 S. Main St., Los Angeles, Cal.
Meyer & Bro. Co., F., 1313 S. Adams St., Peoria, Ill.
Meyer Furnace Co., The, 1300 S. Washington St., Peoria, Ill.
Meyer Mfg. Co., 4823 Wabash Ave., Detroit, Mich.
Michell Air Conditioning Co., Inc., 1725 State St., Schenectady, N. Y.
Michigan Pipe Co., 503 Phoenix Bldg., Bay City, Mich.
Micro Products Co., 20 N. Wacker Dr., Chicago, Ill.
Micro Switch Corp., 1 E. Spring St., Freeport, Ill.
Middleton Mfg. & Sales Co., 125 N. First St., Minneapolis, Minn.
●Midwest Piping & Supply Co., Inc., Second and Barry St., St. Louis, Mo.
Milburn Co., Alexander, 1426 W. Baltimore St., Baltimore, Md.
Milcor Steel Co., S. 41st & Burnham Sts., Milwaukee, Wis.
Miller & Connell Co., 3720 W. North Ave., Chicago, Ill.
Miller Electric Mfg. Co., Inc., 905 N. Meade St., Appleton, Wis.
Millers Falls Co., 57 Wells St., Greenfield, Mass.
Mills Corp., Elmer E., 812 W. Van Buren St., Chicago, Ill.
Mills Novelty Co., 4110 W. Fullerton Ave., Chicago, Ill.
Milwaukee Gas Specialty Co., 2025 W. Clybourn St., Milwaukee, Wis.
Milwaukee Valve Co., S. Burrell St. at E. Hayes Ave., Milwaukee, Wis.
Mineral Insulation Co., 103rd & Southwest Highway, Chicago Ridge, Ill.
●Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn.
Minn-Kota Foundry & Mfg. Co., 201 Second St., N., Fargo, N. D.
Misener Mfg. Co., Inc., 326 E. Washington St., Syracuse, N. Y.
Mississippi Glass Co., 220 Fifth Ave., New York, N. Y.
Mitchell Moulding Co., 1501-15 Circle Ave., Forest Park, Ill.
●Mitchell & Smith, Inc., 9469 Copeland Ave., Detroit, Mich.
Modern Engineering Co., 3411 Pine Blvd., St. Louis, Mo.
●Modine Mfg. Co., 1772 Racine St., Racine, Wis.
Moeller Instrument Co., 132nd St. & 89th Ave., Richmond Hill, N. Y.
Mojonnier Bros. Co., 4601 W. Ohio St., Chicago, Ill.
Moloch Foundry & Machine Co., Kaukauna, Wis.
Monarch Mfg. Works, Inc., Salmon & Westmoreland Sts., Philadelphia, Pa.
Monash-Younker Co., 1315 W. Congress St., Chicago, Ill.
Moncrief Furnace Co., P. O. Box 1673, Atlanta, Ga.
Monitor Controller Co., The, 51 S. Gay St., Baltimore, Md.
Monmouth Products Co., 1929-41 E. 61st St., Cleveland, O.
Monsanto Chemical Co., Organic Chemicals Div., St. Louis, Mo.
Montag Stove & Furnace Wks., 2011 N. Columbia Blvd., Portland, Ore.
Montgomery Bros., 61 Fremont St., San Francisco, Cal.
Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.
Moran Flexible Steam Joint Co., 217 W. Main St., Louisville, Ky.
Morehead Mfg. Co., 4895 Grand River Ave., Detroit, Mich.
Morey & Jones, Ltd., 922 S. Hemlock St., Los Angeles, Cal.
Morris Machine Wks., 50 E. Genesee St., Baldwinsville, N. Y.
Morrison Products, Inc., E. 168th St. and Waterloo Rd., Cleveland, O.
Morse Chain Co., Turner Pl., Ithaca, N. Y.
●Mortell Co., J. W., Kankakee, Ill.
Motex Metal Process Corp., 4473-4475 W. Jefferson Ave., Detroit, Mich.
Mouat Vapor Heating Co., The, 1246-1254 W. 4th St., Cleveland, O.
Mountain States Equipment Co., 1238 Speer Blvd., Denver, Colo.
●Mueller Brass Co., Port Huron, Mich.
Mueller Co., 512 W. Cerro Gordo St., Decatur, Ill.
Mueller Furnace Co., L. J., 2005 W. Oklahoma Ave., Milwaukee, Wis.
Mueller Steam Specialty Co., Inc., 40-20 22nd St., Long Island City, N. Y.
Muncie Gear Wks., Inc., 700 N. Wysor, Muncie Ind.
●Mundet Cork Corp., 65 S. 11th St., Brooklyn, N. Y.
Mundt & Sons, Charles, Jersey City, N. J.
Munn and Steele, Inc., 130 Lister Ave., Newark, N. J.
Murray Iron Wks. Co., 1106 Washington St., Burlington, Ia.
●Murray Mfg. Co., D. J., Wausau, Wis.
Mutual Chemical Co. of America, 270 Madison Ave., New York, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
Myers Electric Co., Inc., 410 Third Ave., Pittsburgh, Pa.

N

●Nash Engineering Co., South Norwalk, Conn.
Nason Co., 1050 Mt. Elliott Ave., Detroit, Mich.
National Airoil Burner Co., Inc., 1284 E. Sedgley Ave., Philadelphia, Pa.
National Aluminate Corp., 6621 W. 66th Pl., Chicago, Ill.
National Brass Co., 1603 Madison Ave., Grand Rapids, Mich.
National Brass & Copper Co., Inc., P.O. Box 365, Lisbon, O.
National Carbon Co., Carbon Sales Div., P. O. Box 6087, Cleveland, O.
National Cylinder Gas Co., 205 W. Wacker Dr., Chicago, Ill.
National Engineering & Mfg. Co., 213 W. 19th St., Kansas City, Mo.
National Engineering Products, Inc., Commerce and Savings Bldg., Washington, D. C.
National Gypsum Co., Delaware Ave., Buffalo, N. Y.
National Heating Co., 401 Essex Bldg., Minneapolis, Minn.
National Lead Co., 111 Broadway, New York, N. Y.
National Machine Wks., Peoples Gas Bldg., Chicago, Ill.
National Mfg. Corp., 151 Fillmore Ave., Tonawanda, N. Y.
National Mfg. & Engineering Co., 1441 Brooklyn Ave,. Detroit, Mich.
National Metal Products Corp., 21 N. Loomis St., Chicago, Ill.
National Meter Co., 4221 First Ave., Brooklyn, N. Y.
National Pipe Bending Co., 122 River St., New Haven, Conn.
National Radiator Co., The, 221 Central Ave., Johnstown, Pa.
National Safety Device Co., 836 W. Hubbard, Chicago, Ill.
National Steam Pump Co., 701 W. Johnson St., Upper Sandusky, O.
National Time & Signal Corp., 600 E. Milwaukee Ave., Detroit, Mich.
National Tube Co., United States Steel Corp. Subsidiary, Frick Bldg., Pittsburgh, Pa.
National Valve & Mfg. Co., 3101 Liberty Ave., Pittsburgh, Pa.
Naugatuck Mfg. Co., Union City, Conn.
Naylor Pipe Co., 1251 E. 92nd St., Chicago, Ill.
Nebel Mfg. Co., P. O. Box 3942, Shaker Sta., Cleveland, O.
Neemes Foundry, Inc., 216 First St., Troy, N. Y.
Nelson Chemical Pumps, Box 2235, Casper, Wyo.
Nelson Co., 2604 Fourth Ave., Detroit, Mich.
Nelson Corp., Herman, 1824 Third Ave., Moline, Ill.
Nelson Mfg. Co., B. F., 401 Main St., N. E., Minneapolis, Minn.
Neptune Meter Co., 50 W. 50th St., New York, N. Y.
●Nesbitt, Inc., John J., State Rd. & Rhawn St., Philadelphia, Pa.
Nevinger Mfg. Co., Inc., Greenville, Ill.
New Albany Machine Mfg. Co., E. 10th & Water Sts., New Albany, Ind.
New Departure Div., General Motors Corp., Bristol, Conn.
New England Cooling Tower Co., 32 Cambridge St., Chas. Sta., Boston, Mass.
New Haven Copper Co., Seymour, Conn.
New Jersey Zinc Sales Co., Front & Fletcher Sts., New York, N. Y.
New York Air Valve Corp., 611-621 Broadway, New York, N. Y.
●New York Blower Co., 3155 Shields Ave., Chicago, Ill.
New York Brass Foundry, 405 Broome St., New York, N. Y.
Newark Wire Cloth Co., 351 Verona Ave., Newark, N. J.
Newman Brothers, Inc., 666 W. Fourth St., Cincinnati, O.
Newman Co., Inc., I. C., 6 E. 45th St., New York, N. Y.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Ninth & Lowell Sts., Newport, Ky.
Niagara Blower Co., 6 E. 45th St., New York, N. Y.
Niagara Machine & Tool Wks., 637-697 Northland Ave., Buffalo, N. Y.
Nice Ball Bearing Co., 30th and Nicetown Lane, Philadelphia, Pa.
Nicholson & Co., W. H., 12 Oregon St., Wilkes-Barre, Pa.
Niles Rolling Mill Co., Niles, O.
Noera Mfg. Co., Div. Chase Brass & Copper Co., Waterbury, Conn.
Norgren Co., C. A., 222 Santa Fe Dr., Denver, Colo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Norman Sheet Metal Mfg. Co., W. F., 212-236 N. Cedar St., Nevada, Mo.
Norristown Magnesia & Asbestos Co., Washington St., Norristown, Pa.
North American Fibre Products Co., The, Standard Bldg., Cleveland, O.
North American Mfg. Co., 2910 E. 75th, Cleveland, O.
North Penn Co., 72 Fifth Ave., New York, N. Y.
Northern Blower Co., 6409 Barberton Ave., Cleveland, O.
Northern Equipment Co., 1945 Grove Drive, Erie, Pa.
Northern Indiana Brass Co., 935 Plum St., Elkhart, Ind.
Northern Steel and Stoker Corp., 3100 Prospect Rd., Peoria, Ill.
Northern Weatherstrip Co., 367 S. First Ave., E. Duluth, Minn.

● Advertisement in this issue. See Index to Advertisers, page 306.

Northwest Stove & Furnace Wks., Inc., 2345 S. E. Gladstone St., Portland, Ore.
Norwin Co., E. Album St., Freeport, Ill.
Norwood Filtration Co., The, N. Maple St., Florence, Mass.
Nu-Way Corp., 2416-4th Ave., Rock Island, Ill.
Nye Tool & Machine Wks., The, 4120-30 Fullerton Ave., Chicago, Ill.

O

Oakite Products, Inc., 22 Thames St., New York, N. Y.
Oberdorfer Brass Co., M. L., 2307 Thompson Rd., Syracuse, N. Y.
O'Brien Steam Specialty Co., 207 Harrison St., Syracuse, N. Y.
O'Brien Varnish Co., South Bend, Ind.
Ohio Brass Co., N. Main St., Mansfield, O.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Works & Foundry Co., 2735 Colerain Ave., Cincinnati, O.
Ohio Pipe Bending & Machine Co., 3900-3910 Trent Ave., Cleveland, O.
Ohl & Son, George A., 159 Oraton St., Newark, N. J.
Ohmlac Paint & Refining Co., 6540 S. Central Ave., Chicago, Ill.
Oil City Tank & Boiler Co., Oil City, Pa.
Oil Well Supply Co., Oil City, Pa.
● O'Neil Irwin Mfg. Co., Inc., 316 Eighth Ave., S., Minneapolis, Minn.
Ormsby-Osterman, Inc., 3631 Cass Ave., St. Louis, Mo.
Orr & Sembower, Inc., Box 1138, Reading, Pa.
Osborn Co., The J. M. & L. A., 1541 E. 38th St., Cleveland, O.
Oster Mfg. Co., 2057 E. 61st Pl., Cleveland, O.
Ostlind Valve, Inc., Portland, Ore.
● Owens-Corning Fiberglas Corp., Nicholas Bldg., Toledo, O.
Ozalid Products Div., General Aniline & Film Corp., Ansco Rd., Johnson City, N. Y.
Ozone Air Co., 928 Cherry St., S. E., Grand Rapids, Mich.
Ozo-Ray Process Corp., 400 N. Sangamon St., Chicago, Ill.

P

Pacific Airmax Corp., 7631 Roseberry Ave., Huntington Park, Cal.
Pacific Lumber Co., The, 100 Bush St., San Francisco, Cal.
Pacific Pump Works, 5716 Bickett St., Huntington Park, Cal.
Pacific States Felt & Mfg. Co., Inc., 845 Howard St., San Francisco, Cal.
Pacific Steel Boiler Div., United States Radiator Corp., 1500 United Artists Bldg., Detroit, Mich.
Packless Metal Products Corp., 31 Winthrop Ave., New Rochelle, N. Y.
Page Steel & Wire, Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Paine Co., 2951 W. Carroll Ave., Chicago, Ill.
Pains Fireworks Display Co., 11 Park Pl., New York, N. Y.
Palmer Co., 2501 Norwood Ave., Cincinnati (Norwood), O.
Palmer Electric Co., 20 Sproat St., Detroit, Mich.
Palmer Mfg. Corp., Phoenix, Ariz.
Palnut Co., 73 Cordier St., Irvington, N. J.
Pan-American Engineering Co., 820 Parker St., Berkeley, Cal.
Pangborn Corp., Pangborn Blvd., Hagerstown, Md.
Paragon Electric Co., 37 W. Van Buren St., Chicago, Ill.
Paragon-Revolute Corp., 65 South Ave., Rochester, N. Y.
Paramount Products Co., 545 Fifth Ave., New York, N. Y.
Parker Appliance Co., The, 17325 Euclid Ave., Cleveland, O.
Parker-Kalon Corp., 200 Varick St., New York, N. Y.
Parkersburg Iron & Steel Co., Parkersburg, W. Va.
Parks-Cramer Co., P.O. Box 444, Fitchburg, Mass.
Parmelee Mfg. Corp., 1925 Dwyer Ave., Utica, N. Y.
Patten Co., J. V., 500 De Kalb Ave., Sycamore, Ill.
Patterson-Ballagh Corp., 1900 E. 65th St., Los Angeles, Cal.
● Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Patterson Shade Co., 1142 N. Meridian St., Indianapolis, Ind.
Payne Furnace & Supply Co., Inc., 336-338 N. Foothill Rd., Beverly Hills, Cal,
Peabody Engineering Corp., 580 Fifth Ave., New York, N. Y.
Pease Co., C. F., The, 2601 W. Irving Park Rd., Chicago, Ill.
Peck & Harvey, 4327 W. Addison St., Chicago, Ill.
Peck, Stow & Wilcox Co., Center St., Southington, Conn.
Pecora Paint Co., 3501 N. 4th St., Philadelphia, Pa.
Pedrick Tool & Machine Co., 3640 N. Lawrence St., Philadelphia, Pa.
Peerless of America, Inc., 333 N. Michigan Ave., Chicago, Ill.
Peerless Electric Co., 3021 W. Market St., Warren, O.
● Peerless Mfg. Corp., 1400 W. Ormsby St., Louisville, Ky.
Peerless Pump Div., Food Machinery Corp., 1250 Camden Ave., S. W., Canton, O.
Peerless Unit Ventilation Co., Inc., 810 Union Ave., Bridgeport, Conn.
Penberthy Injector Co., 1242 Holden Ave., Detroit, Mich.
● Penn Electric Switch Co., Box 556, Goshen, Ind.
Penn Mfg. Corp. of Washington, Pa., 380 W. Chestnut St., P. O. Box 484, Washington, Pa.
Penn Ventilating Co., 3252 Goodman St., Philadelphia, Pa.
Pennsylvania Engineering Wks., 526 S. Jefferson St., New Castle, Pa.
Pennsylvania Flexible Metallic Tubing Co., 72nd St. and Powers Lane, Philadelphia, Pa.
Pennsylvania Forge Co., Milnor & Bleigh Sts., Philadelphia, Pa.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Pennsylvania Salt Mfg. Co., Widener Bldg., Philadelphia, Pa.
% Proportioneers, Inc. %, 9 Codding St., Providence, R. I.
Perfect Circle Co., The, Hagerstown, Ind.
Perfection Grate & Stoker Co., 4 Fisk Ave., Springfield, Mass.
Perfection Refrigeration Parts Co., Harvey, Ill.
Perfex Corp. (Controls Div.), 500 W. Oklahoma Ave., Milwaukee, Wis.
Perham Products, Inc., 133 N. Wacker Dr., Chicago, Ill.
Perkins Machine Co., 4 Perkins Ave., Warren, Mass.
Perkins & Son, Inc., B. F., Chicopee St., Holyoke, Mass.
Permatex Co., Inc., Sheepshead Bay, N. Y.
Permutit Co., 330 W. 42nd St., New York, N. Y.
Pernot & Rich, Inc., 2546 San Fernando Rd., Los Angeles, Cal.
● Petroleum Heat & Power Co., Stamford, Conn.
Petrometer Corp., 1 Star Sq., Long Island City, N. Y.
Pfening Co., Fred D., 1075 W. 5th Ave., Columbus, O.
Phelps Dodge Copper Products Corp., British American Tube Div., 40 Wall St., New York, N. Y.
Phelps Mfg. Co., 801 Thomas St., Little Rock, Ark.
Philadelphia Gear Works, Inc., Erie Ave. & G St., Philadelphia, Pa.
Philadelphia Pipe Bending Co., 4135-65 N. Fifth St., Philadelphia, Pa.
Philadelphia Thermometer Co., 915 Filbert St., Philadelphia, Pa.
Philco Corp., Tioga and C Sts., Philadelphia, Pa.
Phillips & Co., H. A., 3255 W. Carroll Ave., Chicago, Ill.
Phillips Cooling Tower Co., Inc., 114 Liberty St., New York, N. Y.
Phoenix Brass Fittings Corp., Coit St. & Chancellor Ave., Irvington, N. J.
Phoenix Ice Machine Co., 2711 Church St., Cleveland, O.
Phoenix Ventilator Co., Inc., 1665 63rd St., Brooklyn, N. Y.
Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass.
Pier Equipment Mfg. Co., 1440 Milton St., Benton Harbor, Mich.
Pierce Butler Radiator Corp., 701 Nichols Ave., Syracuse, N. Y.
Pierce Co., Wm. B., The, 41 N. Division St., Buffalo, N. Y.
Pilley Brush Co., Fort Madison, Ia.
Pioneer Heat Regulator Div., Master Electric Co., The, 100 Davis Ave., Dayton, O.
Pioneer Roofing & Sheet Metal Co., 226 N. Main St., Muskogee, Okla.
Pipe Fabrication Institute, 1108 Clark Bldg., Pittsburgh, Pa.
Pittsburgh Brass Mfg. Co., 3155 Penn Ave., Pittsburgh, Pa.
Pittsburgh Equitable Meter Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Pittsburgh Lectrodryer Corp., P. O. Box 1766, Pittsburgh, Pa.
Pittsburgh Pipe Coil & Bending Co., 61 Bridge St., Etna, Pa.
Pittsburgh Piping & Equipment Co., 43rd St. & A. V. R. R., Pittsburgh, Pa.
Pittsburgh Plate Glass Co., 2000 Grant Bldg., Pittsburgh, Pa.
Pittsburgh Steel Co., Grant Bldg., Pittsburgh, Pa.
Pittsburgh Tube Co., Hagan Bldg., 323 Fourth Ave., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Pittsburgh Water Heater Co., Box 1109, Pittsburgh, Pa.
Plant Rubber & Asbestos Works, 537 Brannan St., San Francisco, Cal.
Plastergon Wall Board Co., Philadelphia Ave., Buffalo, N. Y.
Plastic Products Co., 6475 Georgia Ave., Detroit, Mich.
Pleasantaire Corp., Tower Bldg., Washington, D. C.
Plibrico Jointless Firebrick Co., 1800 Kingsbury St., Chicago, Ill.
Plummer Spray Equipment Co., 700 Filmore St., Napoleon, O.
Plymouth Cordage Co., Court St., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass., National Sales Agents.
Poe Co., C. W., 2795 E. 83rd St., Cleveland, O.
Pomona Pump Co., 206 E. Commercial St., Pomona, Cal.
Poole Foundry & Machine Co., 1700 Union Ave., Woodberry, Baltimore, Md.
● Porter & Co., Inc., H. W., 825 Frelinghuysen Ave., Newark, N. J.
Powell Co., Wm., 2525 Spring Grove Ave., Cincinnati, O.
Power King Tool Corp., P. O. Box 150, Warsaw, Ind.
Power Piping Div., Blaw Knox Co., 829 Beaver Ave., Pittsburgh, Pa.
● Powers Regulator Co., 2720 Greenview Ave., Chicago, Ill.
Practical Instrument Co., 2717 N. Ashland Ave., Chicago, Ill
Prat-Daniel Corp., Port Chester, N. Y.
Precision Control Co., 899 Bryant St., San Francisco, Cal.
Precision Thermometer & Instrument Co., 1434 Brandywine St., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., 33 W. 60th St., New York, N. Y
Premier Furnace Co., Box 150, Dowagiac, Mich.
Presstite Engineering Co., 3900 Chouteau St., St. Louis, Mo.
Pritchard & Co., J. F., Fidelity Bldg., Kansas City, Mo.
Propellair, Inc., 1345 Lagonda Ave., Springfield, O.
Prox Co., Inc., Frank, 1201 S. First St., Terre Haute, Ind.
Public Works Supply Co., 93 Brookline St., Lynn, Mass.
Puhl & Hepper Mfg. Co., Inc., 6400 W. Florissant Ave., St. Louis, Mo.
Pure Carbonic, Inc., 60 E. 42nd St., New York, N. Y.
Pyott Foundry & Machine Co., 328 N. Sangamon St., Chicago, Ill.
Pyrolite Products Co., 1221-1231 W. 74th St., Cleveland, O.
Pyrometer Instrument Co., 103 Lafayette St., New York, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 306.

Q

Quaker City Iron Wks., Allegheny & Tulip Sts., Philadelphia, Pa.
Quaker Rubber Corp., Comly & Milnor Sts., Philadelphia, Pa.
Quickwork-Whiting, Div. of Whiting Corp., Harvey, Ill.
Quiet Heet Mfg. Co., 135 New Jersey R. R. Ave., Newark, N. J.
Quigley Co., Inc., 56 W. 45th St., New York, N. Y.
Quimby Pump Co., Inc., 340 Thomas St., Newark, N. J.

R

●R-S Products Corp., Germantown Ave., at Wayne Junction, Philadelphia, Pa.
R. U. V. Engineering Corp., 110 E. 42nd St., New York, N. Y.
Radiator Specialty Co., 1722 Dowd Rd., Charlotte, N. C.
Rafter Machine Co., 259 Stephens St., Belleville, N. J.
Raisler Corp., Grimes Sprinkler Div., 129 Amsterdam Ave., New York, N. Y.
Ramsey Chain Co., Inc., 1029 Broadway, Albany, N. Y.
Ramtite Co., The, 2563 W. 18th St., Chicago, Ill.
Ranco, Inc., 601 W. 5th Ave., Columbus, O.
●Randall Graphite Products Corp., 609 W. Lake St., Chicago, Ill.
Ransome Machinery Co., Dunellen, N. J.
Ravena Iron Co., Ravena, N. Y.
Rawlplug Co., Inc., The, 98 Lafayette St., New York, N. Y.
Ray Oil Burner Co., 401-499 Bernal Ave., San Francisco, Cal.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Red Jacket Mfg. Co., Davenport, Ia.
Red Spot Electric Co., 4302 S. Tacoma Way, Tacoma, Wash.
Reed Unit-Fans, Inc., 501 N. St. Patrick St., New Orleans, La.
Reeves Pulley Co., 1000 N. Wilson St., Columbus, Ind.
Reeves Steel & Mfg. Co., Dover, O.
Refinite Corp., Refinite Bldg., Omaha, Neb.
Refractory & Insulation Corp., 120 Wall St., New York, N. Y.
Refrigeration Appliances, Inc., 917-923 W. Lake St., Chicago, Ill.
Refrigeration Economics Co., Inc., 1232 Second St., N. E., Canton, O.
Rega Mfg. Co., 79 Mt. Hope Ave., Rochester, N. Y.
Register & Grille Mfg. Co., Inc., 70 Berry St., Brooklyn, N. Y.
Reichert Float & Mfg. Co., 2238 Smead Ave., Toledo, O.
Reif-Rexoil, Inc., 37-43 Carroll St., Buffalo, N. Y.
Reilly Tar & Chemical Corp., 1615 Merchants Bank Bldg., Indianapolis, Ind.
Reiner & Campbell, Inc., 667 Norwood Terrace, Elizabeth, N. J.
Reliable Perforating Co., 2047 N. Wood St., Chicago, Ill.
Reliable Sheet Metal Engineering Co., 4334-50 S. Knox, Chicago, Ill.
Reliance Automatic Lighting Co., 1929 Mead St., Racine, Wis.
Reliance Electric & Engineering Co., Ivanhoe Rd., Cleveland, O.
Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland, O.
Reliance Refrigerating Machine Co., 3401 N. Kedzie Ave., Chicago, Ill.
Rempe Co., 340 N. Sacramento Blvd., Chicago, Ill.
Rensselaer Valve Co., Ontario St., Cohoes, N. Y.
Reps Tool Co., Inc., 521 Fifth Ave., New York, N. Y.
Republic Flow Meters Co., 2240 Diversey Pkwy., Chicago, Ill.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Republic Steel Corp., Republic Bldg., Cleveland, O.
Republic Steel Corp., Bolt & Nut Div., 1500 Scranton Rd., Cleveland, O.
Research Corp., Chrysler Bldg., New York, N. Y.
●Research Products Corp., 1015 E. Washington Ave., Madison, Wis.
Resisto Pipe & Valve Co., 262 Bridge St., East Cambridge, Mass.
Resistoflex Corp., Belleville, N. J.
Revere Copper and Brass, Incorporated, 230 Park Ave., New York, N. Y.
Rex Clay Products Co., 14414 Dexter Blvd., Detroit, Mich.
Reynolds Electric Co., 2603 W. Congress, Chicago, Ill.
Reynolds Mfg. Co., The, 412 Prospect St., N. E., Grand Rapids, Mich.
Reynolds Mfg. Co., Inc., Springfield, Mo.
Reynolds Metals Co., Federal Reserve Bank Bldg., Richmond, Va.
●Reznor Mfg. Co., Mercer, Pa.
●Rhoads & Sons, J. E., 35 N. Sixth St., Philadelphia, Pa.
Rhode Island Fittings Co., Hillsgrove, R. I.
Rhode Island Humidifier & Ventilating Co., 99 Chauncy St., Boston, Mass.
Rhodes, Inc., M. H., 30 Bartholomew Ave., Hartford, Conn.
Richmond Engineering Co., Inc., 7th and Hospital Sts., Richmond, Va.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
●Ric-wiL Co., 1562 Union Commerce Bldg., Cleveland, O.
Ridge Tool Co., Box 670, Elyria, O.
Rid-Sludge, Inc., 1023 Plymouth Bldg., Minneapolis, Minn.
Riggin Metal Products, Inc., Box 267, Kankakee, Ill.
Riley Stoker Corp,, 9 Neponset St., Worcester, Mass.
Robbins & Myers, Inc., Lagonda Ave., Springfield, O.
Roberts-Gordon Appliance Corp., 137 Arthur St., Buffalo, N. Y.
Roberts-Hamilton Co., 707-715 S. Third St., Minneapolis, Minn.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
Robertson Co., H. H., 2000 Grant Bldg., Pittsburgh, Pa.
Robinson Insulation Co., Great Falls, Mont.
Rochester Lead Works, Inc., 380 Exchange St., Rochester, N. Y.
Rochester Mfg. Co., Inc., 100 Rockwood St., Rochester N,. Y.
Rock Island Register Co., 2435 Fifth Ave., Rock Island, Ill.
Rock River Machine Co., Inc., N. Main St., Janesville, Wis.
Rockwood Mfg. Co., 1801-2001 English Ave., Indianapolis, Ind.
Rockwood Sprinkler Co., 38 Harlow St., Worcester, Mass.
Roessing Mfg. Co., 1616 Noble St., Sharpsburg Branch, Pittsburgh, Pa.
Roller Bearing Co. of America, Whitehead Rd., Trenton, N. J.
Rolyan Corp., 2241 Indiana Ave., Chicago, Ill.
Rome-Turney Radiator Co., Canal St., Rome, N. Y.
Roots-Connersville Blower Corp., 16th St. & Columbia Ave., Connersville, Ind.
Roper Corp., Geo. D., Blackhawk Park Ave., Rockford, Ill.
Rosebraugh Co., W. W., 680 S. 17th St., Salem, Ore.
Rosedale Foundry & Machine Co., Columbus & Preble Aves., N. S., Pittsburgh, Pa.
Ross Engineering Corp., J. O., 350 Madison Ave., New York, N. Y.
Ross Heater & Mfg. Co., Inc., 1407 West Ave., Buffalo, N. Y.
Ross Sprinkler Co., 34 Roberts St., Pasadena, Cal.
Ross Valve Mfg. Co., Inc., 6 Oakwood Ave., Troy, N. Y.
Rotary Mfg. Co., 5718 Long Beach Ave., Los Angeles, Cal.
Rotary Seal Co., 2020 N. Larrabee St., Chicago, Ill.
Roxalin Flexible Finishes, Inc., 800 Magnolia Ave., Elizabeth, N. J.
Roy Pumps, Milton, 1371 E. Mermaid Ave., Philadelphia, Pa.
Royal Air Conditioning Equipment Co., 1024 Westminster Ave., Alhambra, Cal.
Royal Ventilator Co., 415 Locust St., Philadelphia, Pa.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
Ruberoid Co., 500 Fifth Ave., New York, N. Y.
Ruby Chemical Co., 74 McDowell St., Columbus, O.
Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wis.
Ruggles-Klingemann Mfg. Co., 4 Foster Ct., Salem. Mass.
Ruppright, Siegfried, 28 E. 31st St., New York, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Russell Co., F. C., 1836 Euclid Ave., Cleveland, O.
Russell & Co., W. A., Bridgeport, Conn.
Russell Electric Co., 348 W. Huron St., Chicago, Ill.
Russell Mfg. Co., John M., Naugatuck, Conn.
●Rutland Fire Clay Co., Curtis Ave,, Rutland, Vt.
Ruud Mfg. Co., 2934 Smallman St., Pittsburgh, Pa.
Ryerson & Son, Inc., Jos. T., 2558 W. 16th St., Chicago, Ill.
Ryniker Sheet Metal Works, Inc., 122-124 N. 25th St., Billings, Mont.

S

●SKF Industries, Inc., Front St. & Erie Ave., Philadelphia, Pa.
St. Paul Corrugating Co., Wabash and Water Sts., St. Paul, Minn.
Sac Tool Mfg. Co., 1907 Washington Ave., St. Louis, Mo.
Sales & Co., Murray W., 801 W. Baltimore Ave., Detroit, Mich.
Salina Metal Products Co., 9th and Bishop, Salina, Kans.
●Sall Mountain Co., 176 W. Adams St., Chicago, Ill.
Sampsel Time Control, Inc., Spring Valley, Ill.
Samson-United Corp., 1700 University Ave., Rochester, N. Y.
Sandberg Sheet Metal Works, 500 N. E. Union Ave., Portland, Ore.
Sangamo Electric Co., 1301 N. 11th St., Springfield, Ill.
●Sarco Co., Inc., 475 Fifth Ave., New York, N. Y.
Sauereisen Cements Co., 2308 Main St., Sharpsburg, Pa.
Saunders Sons, Inc., D., 25 Atherton St., Yonkers, N. Y.
Sawyer Electrical Mfg. Co., 5701 Smithway, Los Angeles, Cal.
Sawyer-Hare Furnace Co., 5736 12th St., Detroit, Mich.
Scaife Co., 26 Ann St., Oakmont, Pa.
Scanlan-Morris Co., Madison, Wis.
Schade Valve Mfg. Co., 2527 N. Bodine St., Philadelphia, Pa.
Schatz Mfg. Co., Fairview, Poughkeepsie, N. Y.
Schaub Engineering Co., Fred H,. 325 W. Huron St., Chicago, Ill.
Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y.
Schmieg Sheet Metal Works, 312-320 Piquette Ave., Detroit, Mich.
Schneible Co., Claude B., 3951 Lawrence Ave., Chicago, Ill.
Schoedinger, F. O., 322-358 Mt. Vernon Ave., Columbus, O.
Schramm, Inc., West Chester, Pa.
Schubert-Christy Corp., Box 166, Affton Station, St. Louis, Mo.
Schundler & Co., Inc., F. E., 45-15 Vernon Blvd., Long Island City, N. Y.
Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa.

● Advertisement in this issue. See Index to Advertisers, page 306.

Schwitzer-Cummins Co., 1125 Massachusetts Ave., Indianapolis, Ind.
Scientific Instrument Co., 531-535 W. Larned, Detroit, Mich.
Scott-Newcomb, Inc., 1922 Pine St., St. Louis, Mo.
Scott Valve Mfg. Co., 3963 McKinley Ave., Detroit, Mich.
Scovill Mfg. Co., Waterville Div., Waferville, Conn.
Sealed Power Corp., Muskegon, Mich.
Sealkote Corp., 40 S. Clinton St., Chicago, Ill.
Seamlex Co., Inc., 27-27 Jackson Ave., Long Island City, N. Y.
Season-Aire Corp. of America, 20 Bartlett St., Detroit, Mich.
Selas Co., The, Erie Ave. and D St., Philadelphia, Pa.
Sellers Engineering Co., 4860 N. Clark St., Chicago, Ill.
Semco Mfg. Co., 118-120-122 Third Ave., N., Nashville, Tenn.
Semet-Solvay Engineering Corp., 40 Rector St., New York, N. Y.
Semler Co., Jeannette, Pa.
Seneca Wire & Mfg. Co., Fostoria, O.
Servel, Inc., Electric Refrigeration & Air Conditioning Div., 119 Morton Ave., Evansville, Ind.
Service To Industry, Box 133, West Hartford, Conn.
Service Machine Co., 158 Miller St., Elizabeth, N. J.
Shafer Bearing Corp., 35 E. Wacker Dr., Chicago, Ill.
Shallcross Co., 48th and Grays Ferry Rd., Philadelphia, Pa.
Shallcross Controls, Inc., 121 N. Broadway, Milwaukee, Wis.
Shank Co., Cyrus, 625 W. Jackson Blvd., Chicago, Ill.
Sharon Steel Corp., Sharon, Pa.
Shaw Co., Benjamin F., Second & Lombard Sts., Wilmington, Del.
Shaw-Kendall Engineering Co., 120-130 S. Superior St., Toledo, O.
•Shaw-Perkins Mfg. Co., Oliver Bldg., Pittsburgh, Pa.
Sheet Metal Mfg. Co., Inc., 953 Myrtle Ave., Brooklyn, N. Y.
Sheffler-Gross Co., Drexel Bldg., Philadelphia, Pa.
Shreveport Engineering Co., Inc., 1553-55 Texas Ave., Shreveport, La.
Sight Feed Generator Co., 14-18 N. 10th St., Richmond, Ind.
Signal Electric Mfg. Co., Menominee, Mich.
Signal Indicator Co., 140 Cedar St., New York, N. Y.
Silvercote Products, Inc., 161 E. Erie St., Chicago, Ill.
Simplex Ceiling Co., 607 W. 48th St., New York, N. Y.
Simplex Heating Specialty Co., Inc., 1105 Church St., Lynchburg, Va.
Simplex Mfg. Co., 198 N. Main St., Fond du Lac, Wis.
Simplex Oil Heating Corp., 191 Central Ave., Newark, N. J.
Sims Co., 18th & Whitley Sts., Erie, Pa.
Sinker-Davis Co., 230 S. Missouri St., Indianapolis, Ind.
Sipe & Co., James B., Box 8010 S. Hills Branch, Pittsburgh, Pa.
Skidmore Corp., St. Joseph, Mich.
Skilbeck Mfg. Co., 7432-27th Ave., Kenosha, Wis.
Skilsaw, Inc., 5033 Elston Ave., Chicago, Ill.
Skinner Co., M. B., South Bend, Ind.
Skinner Engine Co., 337 W. 12th St., Erie, Pa.
•Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., 1954 N. 9th St., St. Louis, Mo.
Skinner Irrigation Co., 1212 E. Canal St., Troy, O.
Skuttle Mfg. Co., 12989 Greeley Ave., Detroit, Mich.
Slater Mfg. Co., 24 Water St., Wakefield, Mass.
Sly Mfg. Co., W. W., 4700 Train Ave., Cleveland, O.
Small Motors, Inc., 1322 Elston Ave., Chicago, Ill.
•Smith Co., Inc., H. B., The, 57 Main, Westfield, Mass.
Smith, Inc., James Campbell, 1679 Collamer Rd., Cleveland, O.
Smith, Inc., Winfield H., 144 Eaton St., Springville, Erie County, N. Y.
Smith & Kanzler Corp., 516-534 Lidgerwood Ave., Elizabeth, N. J.
Smith-Raymond Co., 1231-33 Tenth Ave., Columbus, Ga.
Smith Twin Tubular Boiler Co., Inc., Cottman St., at State Rd., Philadelphia, Pa.
Smith Welding Equipment Corp., 2633 S. E. Fourth St., Minneapolis, Minn.
Smolensky Valve Co., Inc., 1931 W. 47th St., Cleveland, O.
Smooth-On Mfg. Co., 568-574 Communipaw Ave., Jersey City, N. J.
Snap-On Tools Corp., Kenosha, Wis.
Snead, Herbert S., 205 E. 42nd St., New York, N. Y.
Solvay Sales Corp., 42 Rector St., New York, N. Y.
Somers, Inc., H. J., 6063 Wabash Ave., Detroit, Mich.
Somerville Iron Wks., Somerville, N. J.
Sonneborn Sons, Inc., L., 88 Lexington Ave., New York, N. Y.
Sonner Burner Co., Winfield, Kans.
South Bend Air Products Corp., 304 E. Colfax Ave., South Bend, Ind.
South Chester Tube Co., Front & Thurlow Sts., Chester, Pa.
Southbridge Roofing Co., Inc., Hartwell and Chapin Sts., Southbridge, Mass.
Southern States Iron Roofing Co., Stiles Ave., Savannah, Ga.
•Spang Chalfant, Inc., Div. of National Supply Co., Grant Bldg., Pittsburgh, Pa.
Specialty Converters, Inc., East Braintree, Mass.
Speedmaster Co., The, 1203 Thacker St., Des Plaines, Ill.
Speedway Mfg. Co., 1834 S. 52nd Ave., Chicago (Cicero), Ill.
Spence Engineering Co., Inc., 32 Grant St., Walden, N. Y.
Spencer Heater Div., The Aviation Corp., 164 Park St., Williamsport, Pa.
Spencer Thermostat Co., 34 Forest St., Attleboro, Mass.
Spencer Turbine Co., 486 New Park Ave., Hartford, Conn.
Spoehrer-Lange Co., 3723 Commonwealth St., St. Louis, Mo.
Spray Engineering Co., 112 Central St., Somerville, Mass.
•Spraying Systems Co., 4031 W. Lake St., Chicago, Ill.
Sprayo-Flake Co., 2715 Irving Park Blvd., Chicago, Ill.
Spray-Wheel Air Conditioners, Inc., 1320 Nineteenth St., Denver, Colo.
Sprout-Waldron & Co., Muncy, Pa.
Square D Co., 6060 Rivard St., Detroit, Mich.
Square D Co., Industrial Controller Div., 4041 N. Richards St., Milwaukee, Wis.
Squires Co., C. E., E. 40th St. & Kelley Ave., Cleveland, O.
Stainless & Steel Products Co., 1000 Berry Ave., St. Paul, Minn.
Standard Asbestos Mfg. Co., 820-822 W. Lake St., Chicago, Ill.
Standard Computing Scale Co,. The, Air Conditioning and Refrigeration Div., 2461 E. Grand Blvd., Detroit, Mich.
Standard Engineering Wks., 289 Roosevelt Ave., Pawtucket, R. I.
Standard Fuel Engineering Co., 667 Post Ave., S., Detroit, Mich.
Standard Galvanizing Co., 2619 W. Van Buren St., Chicago, Ill.
Standard Heater & Oil Equipment Co., 245 Cornelison Ave., Jersey City, N. J.
Standard Lime & Stone Co., 2004 First National Bank Bldg., Baltimore, Md.
Standard Pressed Steel Co., Jenkintown, Pa.
Standard Products Co., Fisher Bldg., Detroit, Mich.
Standard Reseater Corp., 423 W. 126th St., New York, N. Y.
Standard Rolling Mills, Inc., 148 Jewel St., Brooklyn, N. Y.
•Standard Stamping & Perforating Co., 3131 W. 49th Pl., Chicago, Ill.
Standard Thermometer, Inc., 65 Shirley St., Boston, Mass.
Standard Transmission Equipment Co., Suite 330, 416 W. 8th St., Los Angeles, Cal.
Standard Tube Co., 14600 Woodward Ave., Highland Park, Mich.
Standard Union Co., 71 Gooding St., Lockport, N. Y.
Stanley Electric Tool Div., The Stanley Works, Elm St., New Britain, Conn.
Staples & Pfeiffer, Ltd., 528 Bryant St., San Francisco, Cal.
Star Electric Motor Co., 197 Grove St., Bloomfield, N. J.
Star Expansion Bolt Co., 147 Cedar St., New York, N. Y.
Star Mfg. Co., Inc., 530 Kinsley Ave., Providence, R. I.
Star Products Co., 130 Walnut Ave., New York, N. Y.
Starr Piano Co., Richmond, Ind.
•Staynew Filter Corp., 11 Centre Park, Rochester, N. Y.
Steamaire Co., Cincinnati, O.
Steel Improvement & Forge Co., 960 Addison Rd., Cleveland, O.
Steel Products Engineering Co., 1205 W. Columbia St., Springfield, O.
Steel and Tubes, Div. of Republic Steel Corp., 224 E. 131st St., Cleveland, O.
Steinhorst & Sons, Inc., Emil, 612 South St., Utica, N. Y.
Stephens-Adamson Mfg. Co., 55 Ridgeway, Aurora, Ill.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Cal.
Sterling Engineering & Mfg. Corp., 114 Business St., Hyde Park, Mass.
Sterling, Inc., 3738 N. Holton St., Milwaukee, Wis.
Stewart Ice Machine Co., 1046 E. 22nd St., Los Angeles, Cal.
Stewart Mfg. Co., 309 Washington St., Orange, N. J.
Stickle Steam Specialties Co., 2215 Valley Ave., Indianapolis, Ind.
Stockham Pipe Fittings Co., 4100 Tenth Ave., N., Birmingham, Ala.
Stok-A-Fire Co., 6504 Olive St., University City, Mo.
Stokermatic Co., 1415 S. State St., Salt Lake City, Utah.
Stokes Rubber Co., Jos., Taylor & Webster, Trenton, N. J.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, 218 S. Geddes St., Syracuse, N. Y.
Strandwitz & Co., Inc., W. J., Jefferson and Master Sts., Camden, N. J.
Strong, Carlisle & Hammond Company, 1392 W. Third St., Cleveland, O.
Struthers Dunn, Inc., 1332 Cherry St., Philadelphia, Pa.
Struthers Wells Corp., Titusville, Pa.
Stuart Co., W. W., 417 Ninth St., Des Moines, Iowa.
Sturtevant Co., B. F., Damon St., Hyde Park, Boston, Mass.
Sudbury Laboratory, South Sudbury, Mass.
Sullivan Valve & Engineering Co., 910 S. Arizona St., Butte, Mont.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Sun-Fire Stoker Corp., New Albany, Ind.
Super Mold Corp., 402 N. Sacramento St., Lodi, Cal.
Super Radiator Corp., 652 Stinson Blvd., Minneapolis, Minn.
Superior Railway Products Corp., 7501 Thomas Blvd., Pittsburgh, Pa.
Superior Sheet Steel Co., The, Division of Continental Steel Corp., Canton-Louisville Rd., Canton, O.
Superior Steel Corp., Grant Bldg., Pittsburgh, Pa.
Superior Valve and Fittings Co., 1509 W. Liberty Ave., Pittsburgh, Pa.
Superstat Co., 38 Walter St., Springfield, Mass.
Supreme Air Filter Co., 126 W. 21st St., New York, N. Y.
Supreme Electric Products Corp., 194 Vassar St., Rochester, N. Y.
Supreme Heater & Ventilating Corp., 1911 N. Market St., St. Louis, Mo.
Surface Combustion, 2375 Dorr St., Toledo, O.
Swaby Mfg. Co., 2330 W. Cermak Rd., Chicago, Ill.
Swaine Mfg. Co., Fred J., 1800 N. Seventh St., St. Louis, Mo.
Swartwout Co., 18511 Euclid Ave., Cleveland, O.
Swift Mfg. Co., 247 McDougall Ave., Detroit, Mich.
Swoboda, Inc., H. O., 13th St., New Brighton, Pa.
Syntron Co., Homer City, Pa.

• Advertisement in this issue. See Index to Advertisers, page 306.

T

Taber Pump Co., 272 Elm St., Buffalo, N. Y.
Taco Heaters, Inc., 342 Madison Ave., New York, N. Y.
Tagliabue Mfg. Co., C. J., 540 Park Ave., Brooklyn, N. Y.
Tallmadge & Co., Webster, 364 Glenwood Ave., East Orange, N. J.
Tal's Prestal Bender, Inc., 759 N. Milwaukee St., Milwaukee, Wis.
●Taylor Forge & Pipe Wks., P. O. Box 485, Chicago, Ill.
Taylor-Hall Welding Corp., 99 Hope Ave., Worcester, Mass.
Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.
Taylor-Winfield Corp., 1052 Mahoning Ave., N. W., Warren, O.
Technical Ply-Woods, 228 N. LaSalle St., Chicago, Ill.
Techtmann Industries, Inc., 828 N. Broadway, Milwaukee, Wis.
Tecumseh Products Co., Tecumseh, Mich.
Telsit Insulation Co., 1933 West Farms Rd., Bronx, N. Y.
Tempil Corp., 132 W. 22nd St., New York, N. Y.
Templeton Bros., 189 Belgrade Ave., Roslindale Station, Boston, Mass.
Templeton Mfg. Co., 114 Business St., Hyde Park, Mass.
Temprite Products Corp., 47 Piquette Ave., Detroit, Mich.
Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Tennessee Products Corp., American National Bank Bldg., Nashville, Tenn.
Tenney Engineering, Inc., 46 Farrand St., Bloomfield, N. J.
Terry Steam Turbine Co., The, P. O. Box 1200, Hartford, Conn.
Textite Corp., 2110 Roscoe St., Chicago, Ill.
Thatcher Furnace Co., Centre St., Garwood, N. J.
Thermal Co., Inc., 1434 N. Fourth St., Milwaukee, Wis.
Therminsul Corp., 1603 Fulford St., Kalamazoo, Mich.
Thermoid Rubber, Div. of Thermoid Co., Whitehead Rd., Trenton, N. J.
Thermo-Mix, Inc., 4009 21st St., Long Island City, N. Y.
Thompson & Co., Box 6757, Pittsburgh, Pa.
Thomson-Gibb Electric Welding Co., 161 Pleasant St., Lynn, Mass.
Thrush & Co., H. A., Peru, Ind.
Thwing-Albert Instrument Co., Penn and Pulaski Sts., Philadelphia, Pa.
Tierney Rotor Ventilator Co., 239 Fourth Ave., S., Minneapolis, Minn.
Tiffin, Eaves Trough Clamp Co., 25 Miami, Tiffin, O.
Tilco-Fin, Inc., 58 Second Ave., Brooklyn, N. Y.
Timken Roller Bearing Co., 1835 Dueber Ave., S. W., Canton, Ohio.
Timken Roller Bearing Co., Steel and Tube Div., Canton, O.
Tippett & Wood, Morris and Warren Sts., Phillipsburg, N. J.
Titeflex Metal Hose Co., 500 Frelinghuysen Ave., Newark, N. J.
Titusville Iron Wks. Co., S. Franklin St., Titusville, Pa.
●Todd Combustion Equipment, Inc., 601 W. 26th St., New York, N. Y.
Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo, Ohio.
Torchweld Equipment Div., National Cylinder Gas Co., 1035 W. Lake St., Chicago, Ill.
Torit Mfg. Co., 292 Walnut St., St. Paul, Minn.
Tork Clock Co., Inc., 1 Grove St., Mt. Vernon, N. Y.
Torrington Co., The, Torrington, Conn.
●Torrington Mfg. Co., 70 Franklin St., Torrington, Conn.
Trade-Wind Motorfans, Inc., 5725 S. Main St., Los Angeles, Cal.
Trageser Copper Wks., Inc., 5000 Grand Ave., Maspeth, Long Island, N. Y.
●Trane Co., The, La Crosse, Wis.
Trent Co., Harold E., Leverington Ave. and Wilde St., Philadelphia, Pa.
Trerice Co., H. O., 1420 W. Lafayette Blvd., Detroit, Mich.
Triangle Mfg. Co., 396 Division St., Oshkosh, Wis.
Trimont Mfg. Co., 55-71 Amory St., Roxbury, Boston, Mass.
Trimount Rotary Power Co., 398 Whiting Ave., East Dedham, Mass.
Trindl Products, Ltd., 2227-AD Calumet Ave., Chicago, Ill.
Triplex Heating Specialty Co., 252 N. Grant, Peru, Ind.
Triumph Ice Machine Co., 107-109 E. Front St., Cincinnati, O.
Tropical Paint & Oil Co., 1244-86 W. 70th St., Cleveland, O.
Troy Engine & Machine Co., Troy, Pa.
Truflo Fan Co., 523 Main St., Harmony, Pa.
Trumbull Electric Mfg. Co., Woodford Ave., Plainville, Conn.
Truscon Steel Co., 1315 Albert St., Youngstown, O.
Tryco Products, Inc., Railroad Sq., Westfield, Mass.
●Tube-Turns, 238 E. Broadway, Louisville, Ky.
Turner Brass Wks., 823-47 Park Ave., Sycamore, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago, Ill.
Tuttle Air Filter Co., Inc., 1014 W. Main St., Louisville, Ky.
●Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn.
XXth Century Heating and Ventilating Co., 71 Ira Ave., Akron, Ohio.

U

●U. S. Air Conditioning Corp., 2101 Kennedy St., N. E., Minneapolis, Minn.
U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles, Cal.
U. S. Electrical Tool Co., 1050 Findlay St., Cincinnati, O.
U. S. Expansion Bolt Co., P. O. Box 827, State St. & P. R. R., York, Pa.
U. S. Machine Corp., Lebanon, Ind.
U. S. Motors Corp., Oshkosh, Wis.
Uehling Instrument Co., 473 Getty Ave., Paterson, N. J.
Una Welding, Inc., 1615 Collamer Ave., E., Cleveland, O.
Underground Steam Construction Co., 73 Pitts St., Boston, Mass.
Unified Air Conditioner Co., Torry Bldg., Duluth, Minn.
Uniflow Mfg. Co., E. Lake Rd., Erie, Pa.
●Union Asbestos & Rubber Co., 54th Ave. and 18th St., Cicero, Ill.
Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Union Iron Wks., 1500 Cascade St., Erie, Pa.
Union Metal Wks., Inc., 80 Carter St., Chelsea, Mass.
Union Steam Pump Co., Capitol Ave., S. W., Battle Creek, Mich.
Union Water Meter Co., 333 Hermon St., Worcester, Mass.
United Cork Companies, Central Ave., Kearny, N. J.
United Electric Controls Co., 69 A St., Boston, Mass.
United Metal Hose Co., Inc., 36-01 43rd Ave., Long Island City, N. Y.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
●United States Gauge Co., 44 Beaver St., New York, N. Y.
United States Gypsum Co., 300 W. Adams St., Chicago, Ill.
United States Mineral Wool Co., 9 S. Clinton St., Chicago, Ill.
United States Ozone Co. of America, Crescent St., Scottdale, Pa.
United States Pipe & Foundry Co., Burlington, N. J.
United States Radiator Corp., 1500 United Artists Bldg., Detroit, Mich.
United States Register Co., Burnham St., Battle Creek, Mich.
United States Rubber Co., 1230 Sixth Ave., New York, N. Y.
United States Steel Corp., 436 Seventh Ave., Pittsburgh, Pa.
●United States Steel Supply Co., 1319 W. Wabansia, Chicago, Ill.
United States Stoneware Co., 60 E. 42nd St., New York, N. Y.
United Superior Union Co., Inc., 29 Ryerson St., Brooklyn, N. Y.
Universal Air Filter Corp., Duluth, Minn.
Universal Cooler Corp., Marion, O.
Universal-Cyclops Steel Corp., Bridgeville, Pa.
Universal Gypsum & Lime Co., 111 W. Washington St., Chicago, Ill.
Universal Motor Co., 323 Universal Ave., Oshkosh, Wis.
Universal Power Corp., 4300 Euclid Ave., Cleveland, O.
Universal Zonolite Insulation Co., 135 S. LaSalle St., Chicago, Ill.
Uno Ventilator Co., 565 Lincoln Ave., Cliftondale, Mass.
Upson Co., Upson Point, Lockport, N. Y.
USHCO Mfg. Co., Inc., 135 Tonawanda St., Buffalo, N. Y.
Utica Radiator Corp., 2201 Dwyer Ave., Utica, N. Y.
Utility Fan Corp., 4851 S. Alameda St., Los Angeles, Cal.
Utility Laboratory, Inc., 330 36th St., Brooklyn, N. Y.

V

Vanderman Mfg. Co., Mansfield Ave., Willimantic, Conn.
Van Dorn Electric Tool Co., Towson, Md.
Van Noorden Co., E., 100 Magazine St., Boston, Mass.
Vapor Car Heating Co., Inc., 80 E. Jackson Blvd., Chicago, Ill.
Vapor Specialty Co., 101 W. 42nd St., New York, N. Y.
Ventilating Products Co., 2800 Cottage Grove Ave., Chicago, Ill.
Verson Allsteel Press Co., 93rd & Kenwood Ave., Chicago, Ill.
Vesco Corp., 1381 Sedgwick Ave., New York, N. Y.
VibraSeal Corp., 2832 E. Grand Blvd., Detroit, Mich.
●Vibration Eliminator Co., 8-22 Astoria Blvd., Astoria, N. Y.
Victaulic Co. of America, 30 Rockefeller Plaza, New York, N. Y.
Victor Electric Products, Inc., 2950 Robertson Rd., Cincinnati, O.
Viking Air Conditioning Corp., 5600 Walworth Ave., Cleveland, Ohio.
Viking Pump Co., Fourth and State Sts., Cedar Falls, Ia.
Viking Shear Co., 1063 W. 19th St., Erie, Pa.
Vilter Mfg. Co., 2148 S. First St., Milwaukee, Wis.
Vinco Co., Inc., The, 305 E. 45th St., New York, N. Y.
Virginia Smelting Co., West Norfolk, Va.
Vita-Screen Ventilator Co., 103 Park Ave., New York, N. Y.
Vogt Machine Co., Henry, 10th & Ormsby Sts., Louisville, Ky.
Vortex Mfg. Co., 687 N. Tillamook St., Portland, Ore.
Voss Co., J. H. H., 785 E. 144th St., Corner of Wales Ave., New York, N. Y.
Vulcan Electric Co., 88-90 Holten St., Danvers, Mass.
Vulcan Radiator Co., 26 Francis Ave., Hartford, Conn.

W

Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo.
Wailes Dove-Hermiston Corp., Westfield, N. J.
Waldron Corp., John, New Brunswick, N. J.
Walker Jamar Co., 367 S. First Ave., E., Duluth, Minn.
Wallace Supplies Mfg. Co., 1310 Diversey Pkwy., Chicago, Ill.
Wallace & Tiernan Co., Inc., Belleville, N. J.

● Advertisement in this issue. See Index to Advertisers, page 306.

Walsh-Holyoke Steam Boiler Co., Holyoke, Mass.
Walsh Refractories Corp., 4070 N. First St., St. Louis, Mo.
Walworth Co., 60 E. 42nd St., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
●Ward Leonard Electric Co., 37 South St., Mt. Vernon, N. Y.
Warlo Corp., 330 W. 42nd St., New York, N. Y.
Warren Earl Co., 3409 McKinney Ave., Houston, Tex.
Warren Electric Appliance Co., Warren Bank & Trust Co. Bldg., Warren, Pa.
Warren Foundry & Pipe Corp., 11 Broadway, New York, N. Y.
Warren Shade Co., Inc., 2905 E. Hennepin Ave., Minneapolis, Minn.
Warren Steam Pump Co., Inc., 300 Bridges Ave., Warren, Mass.
●Warren Webster & Co., 17th and Federal Sts., Camden, N. J.
Washburne & Co., E. G., 207 Fulton St., New York, N. Y.
Water Cooling Corp., 71 Nassau St., New York, N. Y.
Water Cooling Equipment Corp., 1137 Hereford, St. Louis, Mo.
Water Cooling Tower Co., 5501 Cornell Ave., Chicago, Ill.
Water Refining Co., 1123 Barthold, Ft. Wayne, Ind.
Water Service Laboratories, Inc., 423 W. 126th St., New York, N. Y.
Waterfilm Boilers, Inc., 154 Ogden Ave., Jersey City, N. J.
Waterloo Register Co., 600 Anita St., Waterloo, Ia.
Watson & McDaniel Co., 440 N. Marshall, Philadelphia, Pa.
●Watson-Stillman Co., 140 Aldene Rd., Roselle, N. J.
Watts Regulator Co., 10 Embankment St., Lawrence, Mass.
Waukesha Motor Co., Waukesha, Wis.
Waverly Heating Supply Co., 31 Union St., Boston, Mass.
Way Loctor Access Panel Co., 420 Boylston St., Boston, Mass.
Wayne Oil Burner Co., 800 Glasgow Ave., Fort Wayne, Ind.
Weatherhead Co., 300 E. 131st St., Cleveland, O.
Weaver Mfg. Co., Springfield, Ill.
●Webster & Co., Warren, 17th & Federal Sts., Camden, N. J.
●Webster Engineering Co., 419 W. Second St., Tulsa, Okla.
Webster Tallmadge & Co., 364 Glenwood Ave., East Orange, N. J.
Wedge Protectors, Inc., 9522 Richmond Ave., Cleveland, O.
Weil-McLain Co., 641 W. Lake St., Chicago, Ill.
Weil Pump Co., 1528 N. Fremont St., Chicago, Ill.
Weinman Pump Co., 290 Spruce St., Columbus, O.
Weirton Steel Co., Weirton, W. Va.
Weiss & Co., H., 113-115 Mercer St., New York, N. Y.
Weksler Thermometer Corp., 52 W. Houston St., New York, N. Y.
Weldex, Inc., 7326 McDonald Ave., Detroit, Mich.
Welding Apparatus Co., 2750 W. Van Buren St., Chicago, Ill.
Werner Co., Inc., R. D., 380 Second Ave., New York, N. Y.
Westco Div., Pomona Pump Co., 2621 Locust St., St. Louis, Mo.
Western Blower Co., 1800 Airport Way, Seattle, Wash.
●Western Cartridge Co., Brass Mill Div., East Alton, Ill.
Western Chemical Co., 713 Washington St., Kansas City, Mo.
Western Engineering & Mfg. Co., 1726 E. Washington Blvd., Los Angeles, Cal.
Western Felt Wks., 4029-4117 Ogden Ave., Chicago, Ill.
Western Furnaces, Inc., 950 Commerce St., Tacoma, Wash
Western Hanger Co., 55 New Montgomery St., San Francisco, Cal.
Western Precipitation Corp., 1016 W. 9th St., Los Angeles, Cal.
Western Silicair Products, Inc., 72 W. Alameda Ave., Burbank, Cal.
Western Wire & Iron Works, Inc., 957 W. 18th Pl., Chicago, Ill.
Western Wire Products Co., 1415-35 S. 18th St., St. Louis, Mo.
Westfalia Separator Co., 30 Orange St., Bloomfield, N. J.
Westinghouse Electric & Mfg. Co., Bloomfield, N. J.
●Westinghouse Electric & Mfg. Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., 653 Page Blvd., Springfield, Mass.
Westinghouse Electric & Mfg. Co., Mansfield, O.
Westinghouse Electric & Mfg. Co., X-Ray Div., 2519 Wilkens Ave., Baltimore, Md.
Weston Electrical Instrument Corp., 619 Frelinghuysen Ave., Newark, N. J.
Wheatland Tube Co., 606-608 Real Estate Trust Bldg., Philadelphia, Pa.
Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill.
Wheeler Mfg. Co., C. H., 19th, Lehigh & Sedgley Aves., Philadelphia, Pa.
Wheeling Corrugating Co., Wheeling Steel Bldg., Wheeling, W. Va.
Wheeling Machine Products Co., Wheeling, W. Va.
Wheeling Steel Corp., Wheeling Steel Corp. Bldg., Wheeling, W. Va.
White Flo-Matic Corp., 30 Elm St., Hoosick Falls, N. Y.
White Mfg. Co., 2362 University Ave., St. Paul, Minn.
●White-Rodgers Electric Co., 1209 Cass Ave., St. Louis, Mo.
Whiting Stoker Co., 4711-21 W. North Ave., Chicago, Ill.
●Whitlock Mfg. Co., 100 South St., Hartford, Conn.
Whitney Chain & Mfg. Co., The, Bartholomew Ave., Hartford, Conn.
Whitney Mfg. Co., W. A., 636 Race St., Rockford, Ill.
Whitney Metal Tool Co., 110 Forbes St., Rockford, Ill.
Whittington Pump & Engineering Co., 225 S. Meridan St., Indianapolis, Ind.
Wickes Boiler Co., 502 N. Water St., Saginaw, Mich.
Wickes Brothers, 500 N. Tilden St., Saginaw, Mich.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York, N. Y.
Wiedemann Machine Co., 1815 Sedgley Ave., Philadelphia, Pa.
●Wiegand Co., Edwin L., 7610 Thomas Blvd., Pittsburgh, Pa.
Wilcolator Co., 1001 Newark Ave., Elizabeth, N. J.
Wilhelm Co., A., 3rd and Bern Sts., Reading, Pa.
Will-Burt Co., The, Orrville, O.
●Williams & Co., J. H., Buffalo N. Y.
Williams Gauge Co., 1620 Pennsylvania Ave., N. S., Pittsburgh, Pa.
Williams, Inc., F. C., 23841-75 Kean Ave., Dearborn, Mich.
Williams Oil-O-Matic Heating Corp., 1201 East Bell, Bloomington, Ill.
Williams & Son, I. B., Dover, N. H.
Williams Valve Co., D. T., Spring Grove Ave. & Township St., Cincinnati, O.
Williamson Heater Co., 337 W. Fifth St., Cincinnati, O.
Williamsport Engine & Machine Co., 1306 Memorial Ave., Williamsport, Pa.
Willis Steel Corp., 156 N. Academy St., Galesburg, Ill.
Willson Products, Inc., 348 Thorn St., Reading, Pa.
Will-Weld Mfg. Co., Inc., 600-620 S. 15th St., Omaha, Nebr.
Willy's Carbide Tool Co., 1340 W. Vernor Highway, Detroit, Mich.
Wilson & Co., 4100 S. Ashland Ave., Chicago, Ill.
Wilson Co., H. A., The, 105 Chestnut St., Newark, N. J.
●Wilson, Inc., Grant, 4115 W. Taylor St., Chicago, Ill.
Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York N. Y.
●Wing Mfg. Co., L. J., 14th St. & 7th Ave., New York, N. Y.
Wipe-On Corp., 105 Hudson St., New York, N. Y.
Wiss & Sons Co., J., 33 Littleton Ave., Newark, N. J.
Witte Engine Works, 1600 Oakland St., Kansas City, Mo.
Wittenmeier Machinery Co., 850-860 N. Spaulding Ave., Chicago, Ill.
Wodack Electric Tool Corp., 4627 W. Huron St., Chicago, Ill.
Wolff & Munier, Inc., 222 E. 41st St., New York, N. Y.
Wolverine Tube, Div. of Calumet and Hecla Consolidated Copper Co., 1411 Central Ave., Detroit, Mich.
Wood Conversion Co., 1981 First National Bank Bldg., St. Paul, Minn.
Wood Steel Co., Alan, Conshohocken, Pa.
Wood's Sons Co., T. B., 1275 Fifth Ave., Chambersburg, Pa.
Wooster Art Wood, Inc., P. O. Box 198, Wooster, O.
Worner Products Corp., 1019 W. Lake St., Chicago, Ill.
●Worthington Pump & Machinery Corp., Harrison, N. J.
●Worthington Pump & Machinery Corp., Air Conditioning & Refrigeration Div., Harrison, N. J.
Worthington-Gamon Meter Co., Harrison, N. J.
Wright-Austin Co., 315 W. Woodbridge St., Detroit, Mich
Wyckoff & Son Co., A., 100 Home St., Elmira, N. Y.

X

X Laboratories, Inc., 25 W. 45th St., New York, N. Y.
X L Refrigerating Co., 1834 W. 59th St., Chicago, Ill.
●X-Pando Corp., 43-15 Thirty-Sixth St., Long Island City, N. Y.

Y

Yale & Towne Mfg. Co., Stamford, Conn.
Yardley Screen & Weather Strip Co., 138 Parsons Ave., Columbus, O.
●Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.
Yates-American Machine Co., Beloit, Wis.
Yeomans Bros. Co., 1470 N. Dayton St., Chicago, Ill.
Yoder Co., The, 5500 Walworth Ave., Cleveland, O.
York Corrugating Co., Adams St. & W. M. R. R., York, Pa.
York Ice Machinery Corp., Roosevelt Ave., York, Pa.
York Oil Burner Co., Inc., P. R. R. & Jessup Pl., York, Pa.
Yost Mfg. Co., Meadville, Pa.
Young & Bertke Co., 1004-1014 Hulbert Ave., Cincinnati, O.
●Young Radiator Co., 709 S. Marquette St., Racine, Wis.
Young Regulator Co., 4500 Euclid Ave., Cleveland, O.
●Youngstown Sheet & Tube Co., Stambaugh Bldg., Youngstown, O.

Z

Zallea Brothers & Johnson, Taylor and Locust Sts., Wilmington, Del.
Zapon Div., Atlas Powder Co., North Chicago, Ill.
Zeh & Hahnemann Co., 182-200 Vanderpool St., Newark, N. J.
Zenith Electric Co., 152 W. Walton St., Chicago, Ill.
●Zink Co., John, 4401 S. Peoria St., Tulsa, Okla.

● Advertisement in this issue. See Index to Advertisers, page 306.